Railway and Locomotive Engineering

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Taking Back Water.

A gentleman of unmistakably Hibernian origin, but, like the famous Champagne Charley, "good for any mortal thing from this to pitch and toss," fell in with a certain sort of American citizen who is known to the comic papers as Dusty Roads. These two worthies felt somehow or other that it was up to them to give over the pedal form of locomotion which Nature had seen fit to throw their way, and as they desired to come from Philadelphia to New York in the worst way, they naturally hit on a railway.

Dusty Roads knew by experience of the luxurious blind baggage, and explained to his friend what they would have to do just as the train started; but "the best laid schemes o' mice and men gang aft agley," and the same happened to Dusty and Patrick, as hereinafter to be described. At the critical moment when they must get aboard or forever after hold their peace, it turned out that instead of a luxurious blind baggage a tightly closed vestibule car followed the tender, but it was mounted upon a superb six-wheel truck with coil and elliptic springs and equalizers and composite bolsters and all that sort of thing, and Dusty made a dash for the top of the truck timbers and settled him-

TAKING WATER FROM TRACK TROUGH ON THE P. R. R.

self with the air of an old and experienced hand, and he of the Emerald Isle followed more awkwardly, but albeit with sufficient action. When they were both "in to clear," Dusty adjusted his soft felt tile over his face and brought two slits in the crown thereof opposite his eyes, even as the much-to-be-feared automobilist adjusteth his goggles, and the train sped on.

As they neared West Waterveldt, Dusty instructed his companion to hold tight and take it pleasantly, which was, of course, the equivalent for "standing pat" when one is in a reclining position, "because the engine is going to suck up water from the iron track." Pat held his breath and waited. There was a gleam of water below the truck and the sound of the scoop limbering up and stepping down and in—and for the rest suffice it to say that the six-wheel truck with the springs of both kinds and the composite bolsters and all the rest of it was washed clean in the twinkling of an eye, was soused, drenched, deluged and otherwise waterlogged for the space of several very weary hours as it seemed before it ran out into the clear and golden autumn sunlight, cool and jeweled, with many a sparkling gem of dew.

"That's all right," cheerfully shouted dripping Pat, above the drum of the spinning wheels, "Ye did yer best, I know, but begobs, give me a half a minute's warnin' afore she begins to schoop up coal like that, like that, I say. I'd need to take good hould onto me own breath, so I would."

RAILWAY BRIDGE OVER THE KIEL CANAL—GERMAN STATE RAILWAYS.

Flange Wear and Side Bearing Trucks.

Like the poor, wheel flange wear is always with us, but the complaints about it have been increasing rather than diminishing. With the greater wear of wheel flanges there has been noted an increase of wear on the gauge side of rails on the outside of curves. Nickel steel rails on curves have given good results, but the heavy wear of wheel and rail still goes on.

"No remedy has yet been found for excessive wear of wheel flanges," said Mr. Gustav Lindenthal not long ago, when reading a paper on this subject to the members of the New York Railroad Club. The speaker, however, desired to inquire in what direction a remedy might possibly be found. In the first place, he pointed out wear of rail and wheel is nearly absent on tangents and greatest on sharp curves.

As to centrifugal force as a cause of side pressure, bringing wheel and rail hard together on a curve, the usual super-elevation of the out rail has been so successfully adjusted for average speeds as to practically neutralize the side pressure due to this force. The change of direction from straight to curved motion which a truck undergoes when rounding a curve, and the lateral pressure between wheel flange and out rail will be very considerable. In rounding a curve this pressure exists only between the flange of the leading outside wheel and the gauge side of the outside rail. The flanges of the other three wheels do not touch the rails. A truck with a rigid frame and with wheels rigidly fastened to the axles has a tendency to run in a straight line, and on a curve it requires a large lateral force to move the wheels sideways. If wheels were loose on axles or if the axles were free to assume a raidal position on a curve no side pressure would exist and wear would be at a minimum.

As has been pointed out, the work of turning an ordinary truck fall upon the flange of the leading outside wheel, and taking as an example a loaded coal car with a gross load on the wheels of 160,000 lbs., the pressure on the flange of the outside guiding wheel of each truck can be shown to be about 15,000 lbs., or 30,000 lbs. side pressure per car.

The length of wheel base has an important bearing on flange pressure. If the base be long, as is the case with a European car without trucks, the work of turning the car is performed by the front outer wheel and the rear inner wheels. European cars distribute the wear between these wheels and both rails, while American cars concentrate the wear on the guiding wheel and the outer rail. Experiments have shown that the lateral pressure against the rail may vary from 5,600 to 1,500 lbs., depending upon the condition of the contact surfaces of the center bearings.

The center bearing never carries the entire load on the truck. Assuming that one side bearing carries ¼ and the center bearing ¾ of a load of 72,000 lbs. That is 18,000 and 54,000 lbs. respectively. If the side bearings are 30 ins. from the center, we have a flange pressure of 8,029 lbs., which is more than 2½ times the flange pressure from the center bearing alone, or with overload and weak frames it may considerably exceed this figure.

Another interesting condition here arises. The truck passes through a certain amount of elastic deformation in being forced round a curve in this way, and it does not fully right itself when it comes to a tangent again, and a certain amount of flange wear takes place on a tangent before the truck becomes normal again. We have here the explanation of flange wear in the inside rail of tangents at the end of curves.

The sum of the various lateral pressures may now be considered. Centrifugal force, nil. Change of direction of fixed wheels, 15,000 lbs. Average center bearing friction, 3,000 lbs., which may grow to 5,600 lbs., and, including side bearing friction, may reach 13,000 lbs. That is, the outer wheel of each truck of a modern heavy freight car may exert a side pressure of from 18,000 lbs. to 28,000 lbs. when the vertical pressure upon the wheel is 20,000 lbs. under a car weighing 160,000 lbs. gross. The outer rail on a curve is subject to from 45 to 70 per cent. of the vertical wheel pressures, assuming both pressures to be distributed upon a rail 30 ft. long.

The German Society of Mechanical Engineers offers a prize of 6,000 marks for a treatise on locomotive construction embracing the theoretical discussion of its fundamental principles. Its announcement says that in spite of the many treatises on the locomotive there is still lacking an exhaustive theoretical discussion of the thermal, mechanical and geometrical principles involved, such as may serve as a guide in designing engines for special purposes.

Growth of the Locomotive.

BY ANGUS SINCLAIR.

DEVELOPMENT OF THE MULTI-COUPLED LOCOMOTIVE.

The experiment made by the Camden & Amboy people in 1835 of introducing a very heavy locomotive was an act of progress that happened to be a little premature, but the movement towards heavy locomotives did not lag far behind. The Jervis truck introduced the six-wheel engine with a four-wheel truck in front and a single pair of drivers behind, a very simple combination which appealed to the taste for simplicity of railway men. It made a very good engine for a very light train, but increase of business soon demanded something more powerful which brought forth various forms of coupled engines.

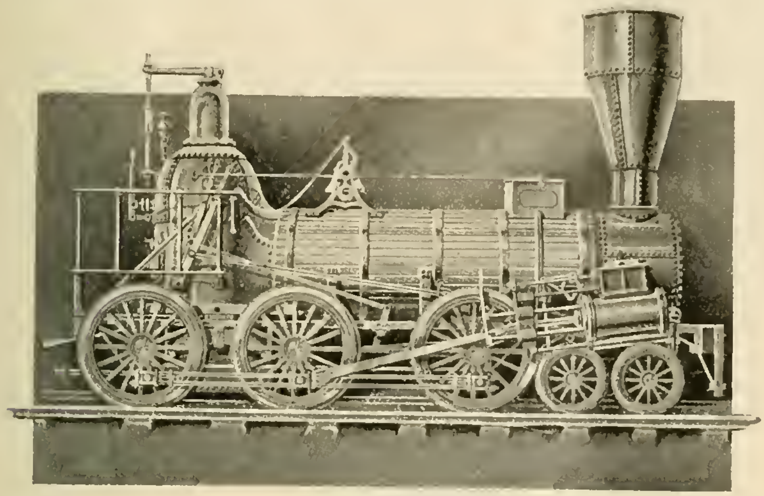


FIG. 74. NORRIS TEN-WHEELER "CHESAPEAKE."

INFLUENCE OF THE CAMPBELL EIGHT-WHEEL ENGINE.

A stride towards increased tractive power was made when Campbell brought out his eight-wheel engine, and that type provided for a good many years of augmentation of capacity before more adhesion wheels were considered necessary except on coal carrying lines. The first American locomotive designer who produced a practical six-coupled engine was Septimus Norris, who patented a ten-wheel engine in 1847. This Norris engine was recognized as the first of a progeny of ten-wheelers that were very fecund and have always stood in high repute with American railroad men.

EARLY SIX-COUPLED ENGINES.

In giving credit for the advance in locomotive designing produced by Campbell, Winans, Baldwin, Septimus Norris and others, we must not forget that multi-coupled engines were successfully used in other countries long before the time of these inventors. In fact, Trevithick's engine was four-coupled, and William Hedley, finding that his four-coupled engine was hard on the light cast iron rails, in 1815 put eight wheels under an engine and coupled them by gear wheels. In the same year George Stephenson used a four-coupled engine and tried to secure the adhesion of the tender wheels by means of an endless-chain motion. Most of the locomotives employed in operating the Stockton & Darlington Railway which was opened in 1825 had four-coupled driving wheels, and one six-coupled engine was placed upon the road in 1827. From that time on, six-coupled engines were common in Great Britain, the principal difference between them and United States multi-coupled locomotives being that the former had no trucks, all the weight be ng carried on the driving wheels.

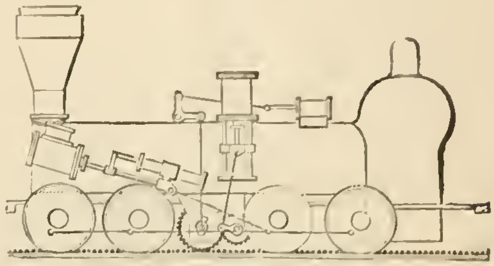


FIG. 76. GEARED LOCOMOTIVE.

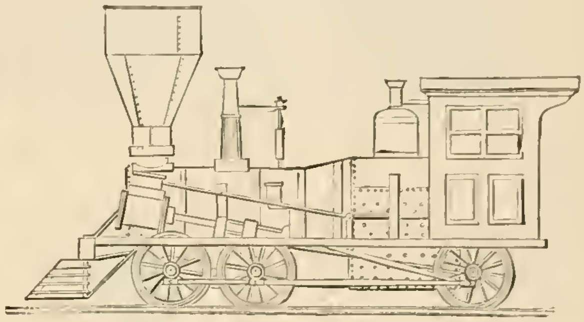


FIG. 77. GRADE CLIMBING ENGINE.

SEPTIMUS NORRIS TEN-WHEELER.

As a locomotive with six or more wheels connected without a leading truck was considered unfit for the fragile track of American railroads, Septimus Norris deserves credit for designing the ten-wheeler which was adapted to the existing conditions. The first engine of this type was built in 1847 by Norris Brothers for the Philadelphia & Reading Railroad, and was called the "Chesapeake."

The drawing of this engine from which the annexed engraving was made was loaned by the grandson of the designer to John A Hill, editor of the *Locomotive Engineer*, who illustrated and described it in August, 1889, and it is here reproduced. Fig. 74.

The engine weighed in working order 44,000 pounds, had cylinders 14½x22 ins. set 75 ins. apart, and the driving

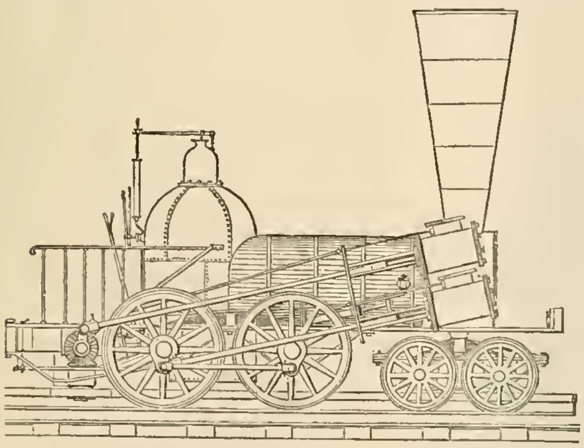


FIG. 75. SELLERS' HILL CLIMBING LOCOMOTIVE.

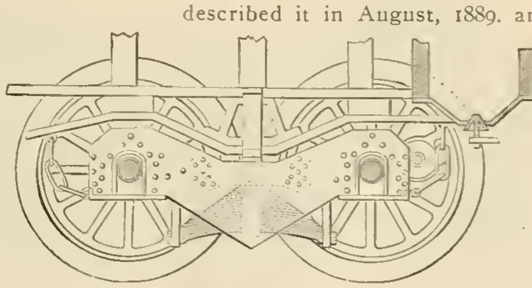


FIG. 78. BALDWIN'S FLEXIBLE TRUCK.

wheels were 46 ins. diameter, axles 5 ins. diameter. The boiler was 44 ins. diameter, the firebox was 37½ ins.

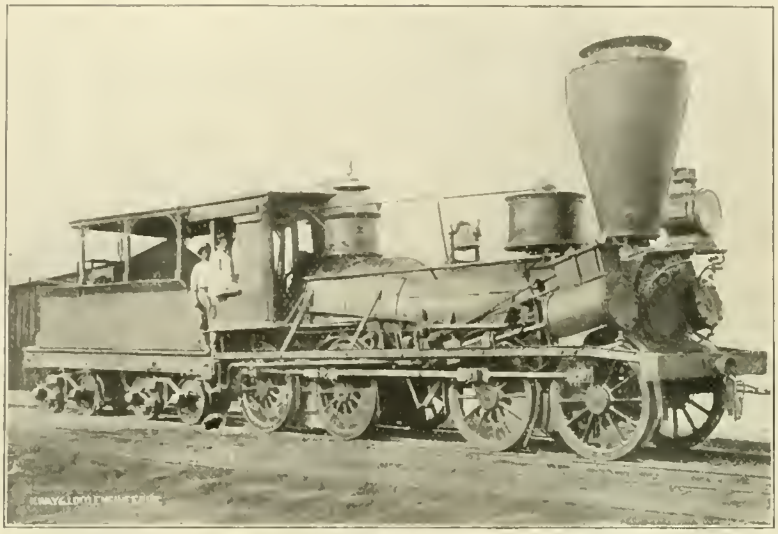


Fig. 79. OLD CUBAN BALDWIN WITH FLEXIBLE DRIVING WHEELS.

square inside and 50 ins. deep. There were 133 2-in. tubes 12 ft. long, the total heating surface being about 880 sq. ft. and the grate area about 10 sq. ft. The duty guaranteed was hauling 890 tons on a level track.

Fears were entertained that this engine would not stay on the track, but no trouble of this kind was experienced. On the contrary, the engines were so successful and popular that the Pennsylvania Railroad Company immediately ordered twenty of them, and it exerted a lasting influence on the motive power of that and other railroads.

A student of locomotive designs and development cannot fail to be struck with the harmonious design of the "Chesapeake" when compared with its forerunners and of many locomotives subsequently built. The work of Septimus Norris was of a very durable character, for his example exerted great influence on locomotive building, and

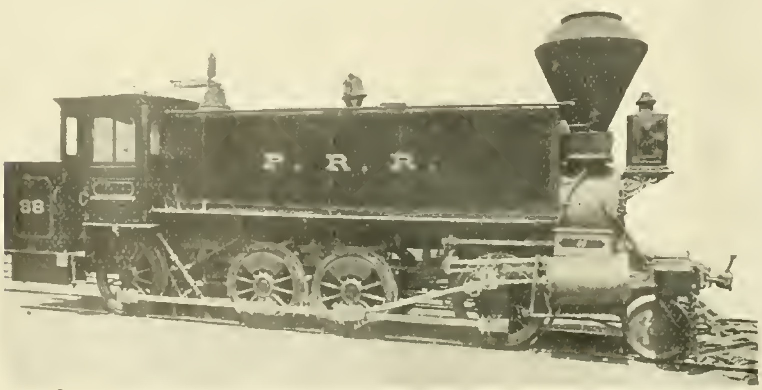


Fig. 81. BALDWIN, BUILT 1854, REMODELED 1865. OLD NUMBER 98.

there were very few unmechanical-looking freight engines built after his time. Nearly all the ten-wheel engines afterwards built by contract shops and railroad companies had a family likeness of Norris' "Chesapeake."

Septimus Norris was a highly cultured mechanical engineer and was author of several technical books that were very popular with the early reading classes of railroad men. He started the Schenectady Locomotive Works, but failing to make the enterprise a financial success sold out to the interests that made these works so famous.

HILL-CLIMBING LOCOMOTIVES.

About the time that Septimus Norris got out his ten-wheeler an agitation arose among engineers and railway men for some special design of locomotive to be used in hill climbing. As early as 1830, Charles Vignoles, a noted French engineer, who gets the credit in Europe of having designed the T-rail, and Capt. John Ericsson worked for some time together on a plan for a middle rail to be used on steep inclines. They achieved no practical results, but in 1847 George Escol Sellers, who had helped to build some of the first engines used by the Philadelphia & Columbia Railroad, put the idea of a middle rail to practical use by designing a form of locomotive with a pair of wheels on a vertical axis which gripped the middle rail and increased the adhesion. He had four eight-wheel engines built for the Panama Railroad after this design which is illustrated in Fig. 75. It will be seen that there are two pairs of cylinders, one

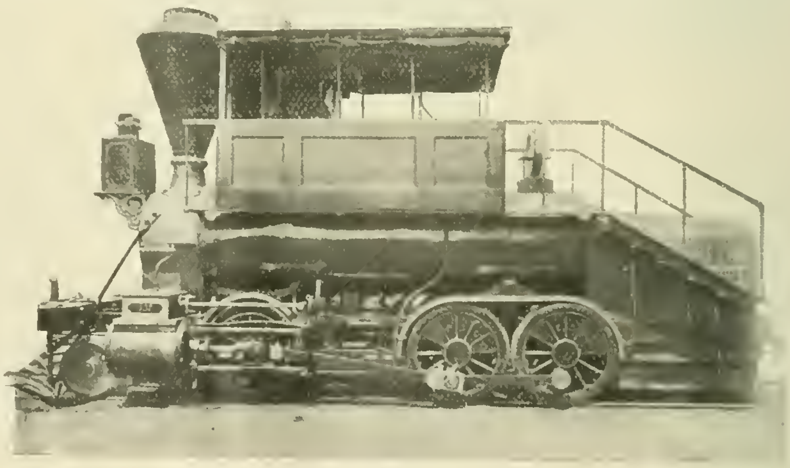
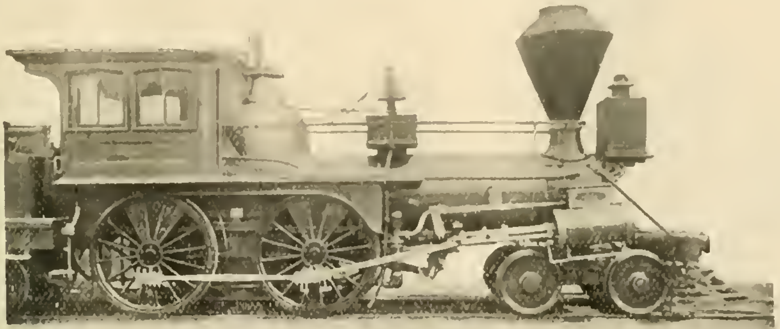


Fig. 80. WINANS' CAMEL, BUILT 1856, REBUILT 1863. OLD NUMBER 80.

above the other, the upper one transmitting power through beveled gearing to wheels which gripped the middle rail, the latter being set four inches above the ordinary rails. For some reason the engines were never put into service on the Panama Railroad, probably because it was found that smooth wheels could climb the comparatively light grades of the road. The Sellers' plan was afterwards developed into the rack rail system which is now used so successfully in this country and in Europe.

There were other hill climbers of a different pattern built about this time, one of them having been turned out of the Baldwin Locomotive Works a few years afterwards for the Madison & Indianapolis Railway. It was a true geared railroad engine and is illustrated in Fig. 76, its mode of operation being very apparent from the illustration. These special forms of grade climbing locomotives were got out through a misapprehension of what performances



BALDWIN, BUILT 1852. OLD NUMBER 26.

smooth wheel locomotives could achieve in climbing steep inclines.

BALDWIN'S GRADE CLIMBERS.

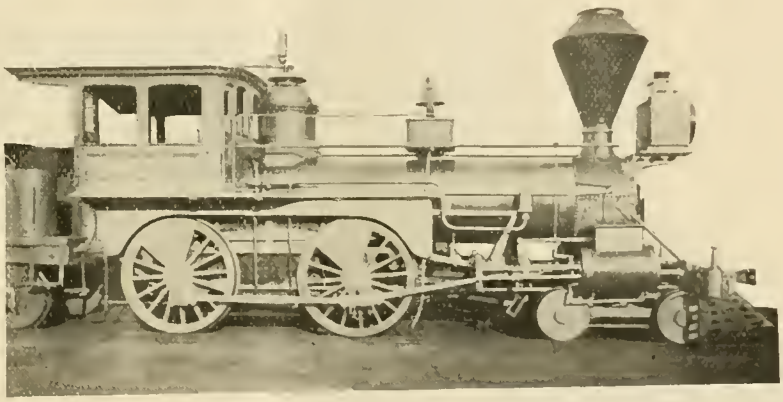
That locomotives with smooth wheels would climb extraordinary steep inclines was demonstrated in the early fifties by use of Baldwin six and eight wheel connected engines with flexible truck whose wheels were connected as drivers. This feature of wheel flexibility obviated the objection to common eight-wheel connected engines that they cut the flanges of the leading drivers, and it materially reduced the frictional resistance in rounding curves.

A report made in 1853 by Charles Ellet, chief engineer of the Virginia Central Railroad, of the performance of some Baldwin engines on a temporary track across the Blue Ridge, gave the engineering world new insight into the grade climbing possibilities of locomotives having ordinary tires. The grade was over 300 ft. to the mile, covered with sharp curves, and it was worked by six-wheel connected Baldwin engines with flexible truck. The engines had cylinders 16½x20 ins., drivers 42 ins. diameter and weighed in working order 55,000 pounds. They hauled a load of fifty tons and had sufficient power to start the train easily from a water tank located in the middle of the steepest grade. This class of engine is illustrated in Fig. 77, but the hill climbers had the wheels set closer.

FLEXIBLE DRIVING-WHEEL BASE.

Mr. Baldwin was not one of the first builders to favor multi-coupled engines, until he invented his four wheel, flexible truck (Fig. 78) and single pair of rigid driving wheels, making a form of running gear that was highly popular for freight traffic. The development of this was the eight-wheel connected engine with the flexible truck leading, coupled with two pairs of drivers, which was illustrated in July last in connection with the early Erie Railroad motive power.

A flexible truck having wheels coupled to one or more pairs of rigid driving wheels looks like a mechanical anomaly,



WILMARTH, BUILT 1852. OLD NUMBER 40.

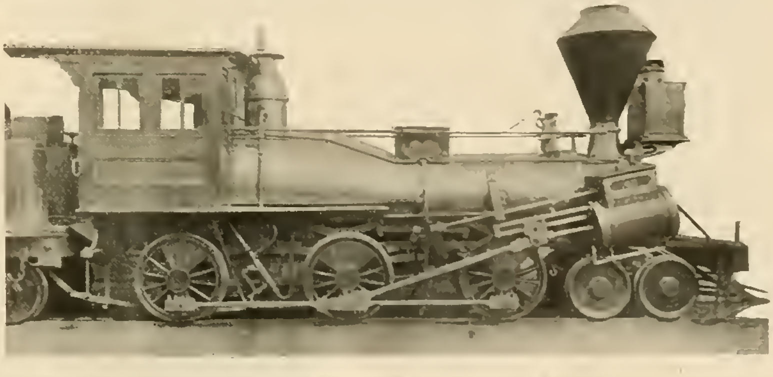
but that was what Mr. Baldwin successfully introduced into locomotive practice. The truck wheels had inside journals running in boxes, held by two wide and deep wrought iron beams, one on each side. These beams were not connected. The pedestals secured on the beams were bored out cylindrically and into them cylindrical boxes were fitted. The engine frame on each side was directly over the truck beam, and a spherical pin running down from the frame, bore in a socket in the beam midway between the two axles. Thus each side beam independently could turn horizontally or vertically under the spherical pin, and the cylindrical boxes could also turn in the pedestals. In passing a curve the truck beams acted like a parallel ruler. The coupling rods were made with cylindrical brasses, forming ball and socket joints that enabled them to accommodate themselves to the lateral movement of the wheels.

OLD CUBAN BALDWIN.

A striking example of extraordinary durability of a Baldwin flexible driving wheel engine is shown in the old Cuban engine that we here illustrate through the courtesy of the *Scientific American*. That engine was built in 1847 for the Havana & Guines Railroad, and is still at work. It bears the well-known characteristics of the old Baldwins, cylinders angling outside the smoke box, projected sand box, riding cut-off and low wagon-top boiler. It looks a brother of No. 129, illustrated among the old Pennsylvania Railroad locomotives.

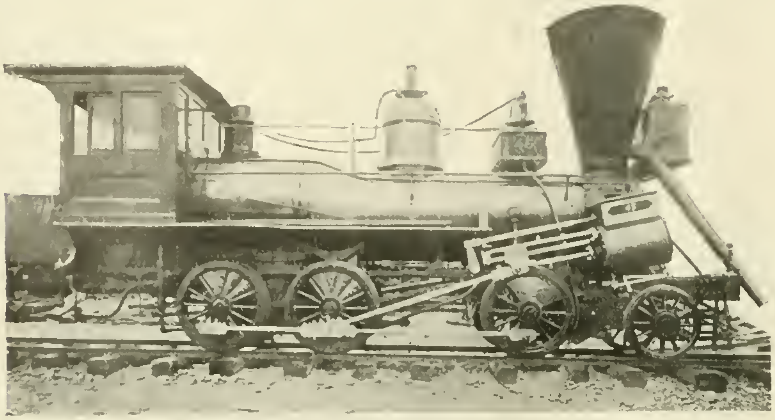
The flexible driving wheel arrangement enabled the Baldwin Locomotive Works to take a prominent part in the introduction of multi-coupled locomotives, but they eventually had to adopt the independent truck, although Mr. Baldwin opposed it for many years. We find that the Pennsylvania Railroad people who had purchased many Baldwin locomotives made changes from their original designs in favor of an independent leading truck, a good example of early experiment being shown in Fig. 79, where a Baldwin flexible truck has one pair of wheels converted into a pony truck.

Another change of the same character is seen in the Seneca, Fig. 80, where



BALDWIN, 1852, NEVER CHANGED. OLD NUMBER 42.

a pony truck has been placed in front of the cylinders of a Winans camel.

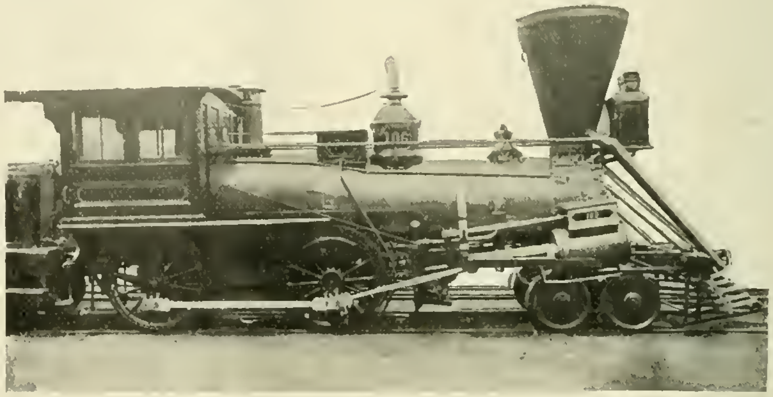


OLD NORTHUMBERLAND BALDWIN, 1853. REBUILT AT ALTOONA, 1857. OLD NUMBER 79.

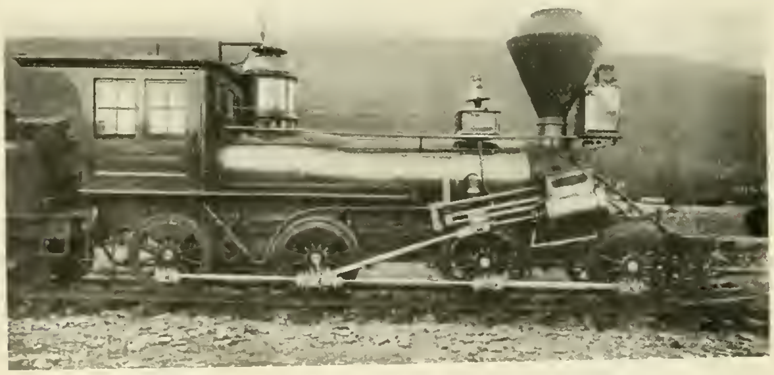
That introduction of the pony truck converting a six-wheel connected engine originated, as already mentioned, with John Laird when he was superintendent of motive power of the Pennsylvania Railroad and adapted the engines to working on the crooked mountain divisions. Laird acknowledged that the pony truck was merely an adaptation of Bissell's truck, brought out for car service.

DEVELOPMENT BY THE PENNSYLVANIA RAILROAD.

In this connection we find Pennsylvania Railroad engine 98 (Fig. 81), which was built by the Baldwin Locomotive Works in 1854, and remodeled at Altoona in 1865 into the same type as the consolidation engine, although Alexander Mitchell's engine, which gave the "consolidation" name to the type, was not built till one year later.



BALDWIN, 1854. NEVER CHANGED. OLD NUMBER 106.



BALDWIN, 1858. NEVER CHANGED. SCRAPPED 1869. OLD NUMBER 129.

I submit a few specimens of the Pennsylvania Railroad locomotives to illustrate the lines of development. Their proportions and appearance represent progress up to the modern locomotive.

FIRST CONSOLIDATION LOCOMOTIVE.

In connection with the development which brought forth the consolidation locomotive the following letter was received from Mr. I. N. Ely, chief of motive power of the Pennsylvania Railroad:

In reply to your memorandum of the 6th instant, with the enclosed letter from Mr. Angus Sinclair, president and editor of RAILWAY AND LOCOMOTIVE ENGINEERING, requesting certain information in regard to old P. R. R. locomotive No. 98.

I have had a personal interview with Messrs. John H. Carr and Amos G. Davis. Mr. W. B. Ford is out of town, and not expected to return until the first of the year. I learned that Mr. Carr had never run locomotive No. 98, and his memory as to the construction of the truck was very hazy. I also had a search made among the old drawings on file in this office, but was unable to find any truck drawings relating to locomotive No. 98. I did find, however, two different types of radial truck, which were shown to both Mr. Carr and Mr. Davis; but, as I have already stated, Mr. Carr's memory was not very strong in regard to this locomotive. Mr. Davis, however, made the statement, with which Mr. Carr coincided, that the locomotive as originally turned out had no truck. It was one of four locomotives of the same type intended for use as mountain helpers, built about 1854, originally named "Quaker City," "Iron City," "Pennsylvania" and "Bedford," and numbered 94, 95, 97 and 98, respectively.

As originally built, locomotive No. 98 was fitted with a tender. The application of the large saddle tank and the coal box at the rear of the cab was of very much later date, when the locomotive was used

BALDWIN, 1857. SCRAPPED 1869. OLD NUMBER 136.

as a shifter. For some reason which Mr. Davis could not explain, Mr. Laird concluded to equip the locomotive with a two-wheel truck; possibly it was for the purpose of saving the flanges of the front drivers. The truck, from the point of view of to-day, was one of the crudest type, and was not fitted with any springs of its own. The axle was made with large diameter collars shrunk on inside of the journals. The journal boxes were of about the same type as used to-day on the leading truck for P. R. R. consolidation and Mogul locomotives, but they were not connected together crosswise by any frame or brace. In a projection on the top of the box was formed a sponge box filled with waste, and to it was bolted two rectangular horizontal equalizer bars extending to the rear far enough to have the rear end attached to the front hanger of the front driving spring; the rear end of which was hung from the main frame in the usual manner. To the equalizer bar on each side of the locomotive was attached a fulcrum shoe, flat on the top, bearing against a plate fastened to the underside of the main frame, with lips in front and rear to limit the fore and aft movement of the equalizer, and used as a substitute for a center pin as it exists to-day in the tail brace or radius bar of such trucks. To this fulcrum shoe, I am told, there was attached a brace extending from it forward to the underside of the truck journal boxes. The attachment of this brace to the fulcrum shoe would appear to be incorrect, because it would certainly prevent vertical oscillations of the equalizer bar, and would put a very heavy stress on the fulcrum shoe and its connections, both to the equalizer and to the brace. I am rather inclined to believe, therefore, that the rear end of the brace was not attached to the fulcrum shoe, but to the equalizers themselves. When the locomotive was first turned out of the shop with this new outfit, the fulcrum shoes were placed well forward towards the truck axle. It was found, however, that in passing around the first curve the truck wheels went off the track; the lateral movement of the whole rig being very limited, and the fulcrum being placed too far away from the front driving wheels. The object in placing them at that point was undoubtedly to get sufficient weight on the truck wheels. The fulcrum shoes were then moved some considerable distance back until the final location was adopted, which was much closer to the rear end than to the forward end. This, of course, greatly cut down the weight on the truck wheels; and it was stated by Mr. Carr that it was not a difficult thing to raise the truck wheels from the rail by the use of a pinch-bar.

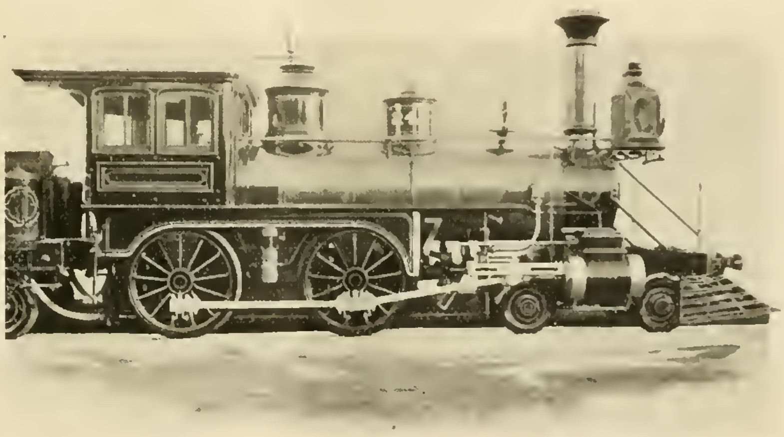
I am unable to say for how long a time this truck arrangement was in use. The locomotive was finally cut up in 1870, and replaced with a standard class "E," which, as you know, was of the ten-wheel type.

The photograph of this locomotive is returned herewith, as per the request of Mr. Sinclair.

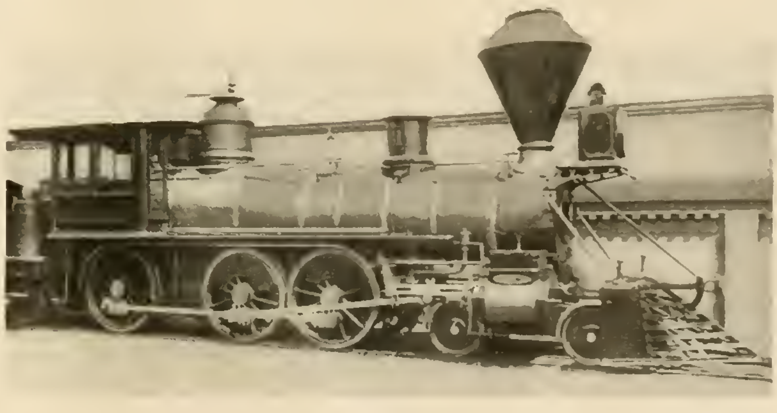
Yours very truly,
A. S. Vogt,
Mechanical Engineer.

(To be continued.)

LANCASTER, 1857. SCRAPPED 1870. OLD NUMBER 145.



PENNSYLVANIA RAILROAD, 1870. SOLD 1891. OLD NUMBER 247.



NEW JERSEY LOCOMOTIVE & MACHINE CO., 1867. SCRAPPED 1887. OLD NUMBER 417.

Combustion or the Source of Energy of a Locomotive.

Here is what an English engineer says of what they call over there the engine-driver: "There in an idea abroad that unless the steam is blowing madly through the safety-valve, there can be no great demonstration of enginemanship." This quotation was given by Mr. T. J. Henderson when reading his very interesting paper on Combustion, or the Source of Energy in the Locomotive, before the Pacific Coast Railway Club at one of its recent meetings.

Commenting on the current opinion as given above, Mr. Henderson said: There can be no greater mistake, for, when steam, water and fuel are blown away through the pop valve, it is positive proof of the existing of the following evils: The engine is too small for the work or it is too great for the men. A test at Purdue University showed that the blowing off of steam through the safety valve for four consecutive minutes, six cubic feet, or 336 lbs. of water was converted into steam and blown away at the rate of 84 lbs. of water per minute.

In ordinary work about 6 lbs. of water are converted into steam for each pound of coal burned and about 12 lbs. per pound of crude oil. The amount of coal wasted in the four minutes referred to was 56 lbs., or ¼ of a pound of coal for every second the safeties blew. In forty seconds 10 lbs. or about one shovelful of coal would be wasted.

There are two kinds of engineers and two kinds of firemen, therefore, there are two ways of running and two ways of firing a locomotive. The economical engineer is the one who does the right thing at the right time, has confidence in his own ability, never gets in a hurry and is generally on time. He does not condemn the Traveling Engineers' Association on the form of examination it has adopted. He reads and keeps up with the times and is not afraid to discuss questions with the fireman.

Combustion or fire is the result of the rapid union of oxygen with carbon at a high degree of temperature, thus producing heat and light. It simply means decay in a rapid form. One unit of heat equals about 772 foot-pounds of work, or, to put it another way, 772 lbs. raised one foot high. The perfect combustion of 10 lbs. of coal, one shovelful, gives 140,000 units of heat and this will raise 772 lbs. 100,000,000 ft. high, or 100 tons 526 ft. high. The raising of 33,000 lbs. 1 ft. high (per minute) equals one horse power; therefore, the loss at the pop of one shovelful of coal about equals a waste of 3.187 h.p.

Practically it is impossible to obtain as good results as these would indicate, even with the best mechanical appliances, on account of the many leaks and avenues for waste connected with the operation of a locomotive.

The 1904 Proceedings of the Master Mechanics' Association.

The report of the proceedings of the Thirty-seventh Annual Convention of the American Railway Master Mechanics' Association has been issued. This book is bound in black cloth with leather back and corners and is uniform in size and binding with what has of late years become the standard form of publication of both the M. M. and the M. C. B. Associations.

The proceedings, which cover the work of the Association during 1904, is a book of 552 pages and contains upwards of fourteen reports of committees on thoroughly practical subjects and also the discussions which took place on them. The reports are well illustrated and the whole work is excellently printed; it has been carefully edited and arranged and has a very good reference index. The M. M. standards and the recommendations of the Association are printed at the back of the book. A very valuable collection consists of the M. M. specifications for various manufactured materials and for designs. The book can be had from Mr. Joseph W. Taylor, secretary of the Association, whose address is 658 The Rookery Building, Chicago, Ill.

Awards to the Pennsylvania.

The Pennsylvania Railroad System has received some very flattering awards from the juries of the Louisiana Purchase Exposition, which closed in the late fall of 1904. The first was a special grand prize for its original series of scientific investigations of locomotive performance conducted at the Louisiana Purchase Exposition, the methods and results of which are a permanent contribution to the advancement of engineering knowledge. The Committee of Five, composing the Superior Jury, was unanimous in this action, and each member individually expressed his high appreciation of the magnificent work done by the Pennsylvania Railroad System in establishing and conducting this testing plant.

2d.—In the Department of Liberal Arts, Group 26: A Grand Prize for the model of the Terminal Passenger Station in New York City.

3d.—In the Department of Transportation Exhibits, Group 74: A Grand Prize for (*a*) The Locomotive Testing Plant and Laboratory. (*b*) The Railway Postal and Mail Car. (*c*) The Model of the West Philadelphia Terminal. (*d*) The Model of the New York and Long Island Railroad Tunnels. (*e*) Full Sized Section of Tunnel under the North River. (*f*) Exhibit of Maps and Drawings illustrating the following improvements made on the Pennsylvania Railroad:

4th.—A Grand Prize to the Société Alsacienne de Construction Mécanique for the De Glehn four-cylinder balanced compound locomotive.

5th.—A commemorative Gold Medal in connection with the exhibit of the De Glehn compound.

6th.—In the Department of Social Economy, Group No. 138, a Gold Medal for the exhibit of the Pension, Relief and Saving Fund Departments, of the Pennsylvania Railroad, and for the lines west of Pittsburgh. Also a Gold Medal for the Pennsylvania Railroad Department Y. M. C. A., of Philadelphia.

7th.—Gold Medals were also awarded to each of the collaborators in connection with the preparation of the exhibits of the testing plant.

Do Roundhouse Repairs Promptly.

Very heavy locomotives cannot be operated with any measure of success unless they are kept in first-class running order. Many railway companies are discovering that facilities for carrying out running repairs promptly are of much greater importance than they were in the days of light locomotives. When the motive power department fails to supply engines as fast as they are wanted the explanation usually given is "The company is short of power." When closely investigated it is found that the road is not short of power, but that it is short of facilities to execute minor repairs promptly. When one engine remains in the roundhouse a week because a crank pin had broken, another was three days out of service on account of a broken eccentric strap, and a third was laid up three weeks with a broken cylinder, the conditions mean that the roundhouse force and facilities want strengthening.

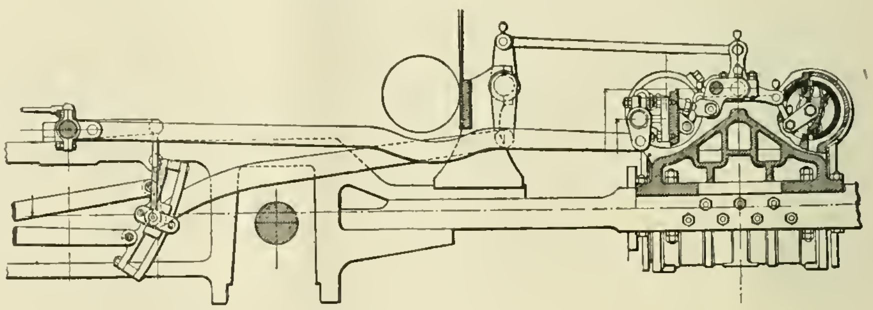


DIAGRAM OF YOUNG'S ROTARY VALVE GEAR.

B. & O. Construction Work.

During the calendar year of 1904, the construction department of the Baltimore & Ohio Railroad have changed 29.35 miles of track, built 55.4 miles of new road, and 86.35 miles of second track. This work includes the construction of the Point Pleasant, Buckhannon & Tygart's Valley Railroad, from Lemley Junction to Buckhannon, W. Va., a distance of 12.6 miles; the second track between New Castle Junction and Strouthers, Ohio, a distance of 14.2 miles; double track, from Haselton to Niles, Ohio, a distance of 8.5 miles; from Niles, Ohio, to Cuyahoga Falls, an entirely new double track line has been built, a distance of 42.8 miles, and changes of alignment and grades have been made and second track constructed from Flushing, Ohio, to Fairport, Ohio, a distance of 11.27 miles, and from Barton to Bridgeport, Ohio, a distance of 9.15 miles.

A 4-4-2 Engine on the Chicago & North-Western, with the Young Valve.

The American Locomotive Company some time ago built some 4-4-2 engines for the Chicago & North-Western Railway, which, after they had been in service for some time, two of them were equipped by their owners with a rotary form of main valve which is giving entire satisfaction.

The engines have 20x26 in. cylinders and 81 in. driving wheels, and 91,000 pounds carried on these wheels. The total weight in working order is 162,500 pounds, and the weight of engine and tender together is 268,050 pounds, the tractive effort being about 22,100 pounds.

The valve motion is indirect, the eccentric being on the rear driver, a transmission bar goes over the forward axle and is attached to the lower end of a two-arm veritcal rocker in the usual way. The valve stem, though not shown so in our engraving, has been made adjustable, and its far end is pinned to a three-arm rocker, one arm being vertical and the other two, horizontal. These two horizontal arms are attached by short links to the valve cranks and the oscillation of the three-arm rocker gives a rocking motion to the valves.

The object of the device was to provide a locomotive with a valve gear which would enable it to get up to and maintain higher speeds than can be had with ordinary D-slide or piston valves. In fact, it is the application of the Corliss valve principle to a locomotive. There is an ingenious arrangement in this gear whereby the variation of lead is made to conform to changes of cut-off.

The wrist-plate as the three-arm rocker is called, is sustained by a pin at the point where the three arms meet, and this wrist-pin is held up by one arm of a bell crank, which swings about a permanently fixed center, and this fixed center is shown shaded in our line cut. The lower end of the bell crank is connected to a small two-arm rocker, the bottom end of which rocker is connected to a rod running from a short crank on the tumbling shaft.

If the tumbling shaft is moved up or down it pulls this rod which in turn moves the bell crank and raises the whole wrist plate, and the valves move slightly inward on their seats, in proportion as the reverse lever is hooked up or let down. When the reverse lever is notched up or down the valves rock over a different area in their chambers, and the notching up or down also changes the travel in the usual way.

Speaking of this gear Mr. Robert Quayle, superintendent of motive power and machinery, says in a letter, from which we make some extracts:

"The Young valve and gear has been developed on the C. & N. W. Railway, under the direct supervision of Mr. O. W. Young. There are at present on the Chicago & North-Western Railway two locomotives equipped with the Young valve and gear, which is a system of rocking valves (two to each cylinder), which are operated by the usual eccentrics and links of the Stevenson motion. The construction of the valves requires an especial cylinder casting and therefore it cannot be used without a complete change.

"The improvements shown by the indicator cards are not entirely realized in actual performance records. In a series of comparisons made by the indicator the water rate per indicator horse power was reduced from 22.9 to 19.3. The indicator cards also show the cause for the slight wear on the machinery, as the cards are remarkably full, the expansion lines being clear and distinct at all points of cut-off. Most of the work in passenger service is done at less than 6 in. cut-off. On account of the high and full cards it is evident that the crank effort is uniform and higher than a slide valved engine. Besides causing less wear on the machinery, this gives a more even torque when starting and the consequently less slipping.

"The engine is one which will bear thorough investigation. While our experiments have been made in passenger service I consider that the performance in freight service will show even better results from both an operation and economical standpoint."

FAST 4-4-2 ENGINE ON THE CHICAGO & NORTH-WESTERN WITH THE YOUNG ROTARY VALVES.
R. Quayle, Superintendent Motive Power and Machinery. American Locomotive Company, Builders.

A few of the leading inventions of these engines are as follows:

Wheel base—Driving, 7 ft., rigid 16 ft., total, 26 ft. 9 ins ; total, engine and tender, 54 ft. 8¾ ins.

Heating surface—Tubes, 2816.9 sq ft ; firebox, 170.7 sq. ft.; arch tubes, 28.27 sq. ft.; total, 3015.85 sq. ft.

Grate area, 46.2 sq. ft.

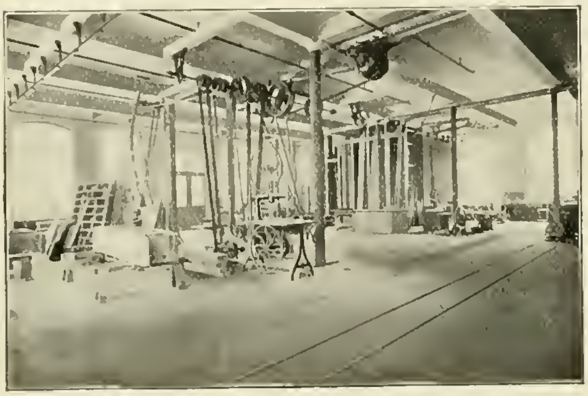
Axles—Driving journals, 9x12 ins.; engine truck journals, diameter, 6 ins.; length, 10 ins ; trailing truck journals, diameter, 7½ ins ; length, 12 ins.; tender, truck journals, diameter, 5 ins.; length, 9 ins.

Boiler—Type straight, first ring, 65⅝ ins.; working pressure, 200 ins.

Firebox—Length, $102\frac{1}{8}$ ins.; width, $65\frac{1}{4}$ ins.; thickness of crown, $\frac{3}{8}$ in.; tube, $\frac{1}{2}$ in.; sides, $\frac{3}{8}$ in.; back, $\frac{3}{8}$ in.; water space, front 4 and 5 ins.; sides, $3\frac{1}{2}$ and $5\frac{1}{2}$ ins.; back, $3\frac{1}{2}$ and $4\frac{1}{2}$ ins.
Crown staying—Radial, 1 in. diam.
Tubes—Number, 338; diam., 2 ins.; length, 16 ft.; gauge, number 12 B. W. G.
Tender frame—10 in. steel channels.
Tank—Capacity, 5,400 gallons; fuel, 10 tons.

A Modern Pattern Shop.

The new pattern building of the B. F. Sturtevant Co., at Hyde Park, Mass., is divided midway of its length by fire walls enclosing stairs, elevators, etc., etc.



FLASK SHOP, B. F. STURTEVANT CO.

One-half the building, with stories respectively 17 and 15 ft., is devoted to the flask and pattern making rooms, while the other half, provided with intermediate floors, making four in all, is utilized for pattern storage.

The flask-shop, 60 by 80 ft., is equipped with band, cross-cut and splitting saws, boring machines and lathe, all driven by a 10 h.p. Sturtevant motor suspended from the ceiling. The industrial railway runs directly into this room from the foundry across a distance of about 40 ft., and together with an overhead transfer track reduces to a minimum the cost of handling flasks. The lumber for their manufacture is unloaded from cars directly in front of the building. This room includes the metal pattern makers' department equipped with the necessary machine tools. Adjacent thereto is the locker, wash and toilet room for the building.

Immediately above, is the pattern shop abundantly lighted upon three sides and equipped with a full complement of tools including one single and two double saw benches, two band saws, a buzz planer and a double surfacer, five lathes, one of which is a 6 ft. by $11\frac{1}{2}$ in. gap lathe, a drill press, a core box machine, numerous wood trimmers, etc. All the power machines are operated by two 10 h.p. Sturtevant motors, both being required for ordinary work, but one always serving as a possible relay in case of accident.

The benches, which accommodate two men each and measure 2 ft. 6 in. in width by 16 ft. in length, are so arranged along the sides of the building that the men all receive a left-shoulder light. Behind each bench is a working table 4 ft. wide by 16 ft. long. The benches are supported by cast-iron legs of special design, which were built by the Sturtevant Company; the same design is used throughout the plant. They are equipped with Emmert vises and their tops are of heavy maple plank. A drying chamber for glued work is provided which receives warm air through the general heat flue from a Sturtevant heating apparatus below.

The first floor of the pattern storage end of the building is of concrete and is designed for the keeping of heavy cast-iron patterns. It is served by an industrial railway and turn-table which permits of transfer to the elevator and thence to other floors. Communication between the pattern shop and storage department is direct, while the fire risk is reduced to a minimum by a double system of fire doors. Around the pipe columns which support the floors are clamped the pattern shelving brackets which are adjustable to any height. Shelves on the walls afford excellent storage space for the smaller patterns.

Railroads Help to Educate Farmers.

Many railroads beyond the Mississippi are assisting in a sort of agricultural educational crusade. Meetings are being held at various points along the various lines of railway for the purpose of educating the farmers in the use of better seeds and in the adoption of more modern methods of farming. Men holding the positions of professors in agricultural colleges and on experimental farms speak at these meetings.

The part played by the railroads is, of course, the transportation part and special trains are run loaded with quantities of seed corn, wheat, etc., an accommodation is provided for the professors and their assistants on these educational trains. The C., R. I. & P. went into this matter last year and carried on a vigorous campaign with a view of helping to increase the grain crop in their territory, and results prove the wisdom of the innovation. The C., M. & St. P. are doing the same thing this year in the State of South Dakota.

RAILWAY AND LOCOMOTIVE ENGINEERING with the December issue closed the 17th volume of its career. It does not seem so long since Mr. John A. Hill left Pueblo to launch out as a magazine writer and manager. Mr. Hill's first newspaper work was probably on this paper back in the '80s. He built well when he founded the *Locomotive Engineer*, and after several years he sold his interests to Mr. Angus Sinclair and associates who have steadily advanced the great engineering journal until it has no rival. The year 1905 will see more improvements, and no railroad man can afford to be without it.—*Pueblo* (*Colo.*) *Opinion*.

The Railway Auto.

The automobile has made its entry on steam railroads, and as long as it keeps clear of regular and signal trains, it is likely to stay, principally in the capacity of an inspection vehicle. Quite a number of these motor cars have been introduced on railways and on a spur line out in Utah a gasoline motor of this description has been used for passenger service.

Not long ago a light touring car was used on the Great Northern for inspection trips. Special wheels with flanges corresponding to those used in standard railroad practice were used. The tread of each wheel with the flange was faced with rubber. A new gasoline motor car was tried not long ago on the C., B. & Q. and proved to be a complete success. It has rendered excellent service on one of the smaller branch lines in passenger and mail service.

Steam motor coaches are familiar objects on British railways and have been known there since 1893. On the continent, gasoline track automobiles have been employed in regular railway work for some time. For short trips between a city station and a regular main line junction where through trains stop only a few minutes to pick up passengers the railway auto ought to fill a long-felt want.

VIEW OF THE PATTERN SHOP.

General Correspondence.

Locomotive Counterbalancing.

The counterbalancing of an engine appears to be one of those points about which shop men are very hazy, or else they look upon it as one of those theoretical matters that only the "mahogany desk men" up in the office waste their time upon.

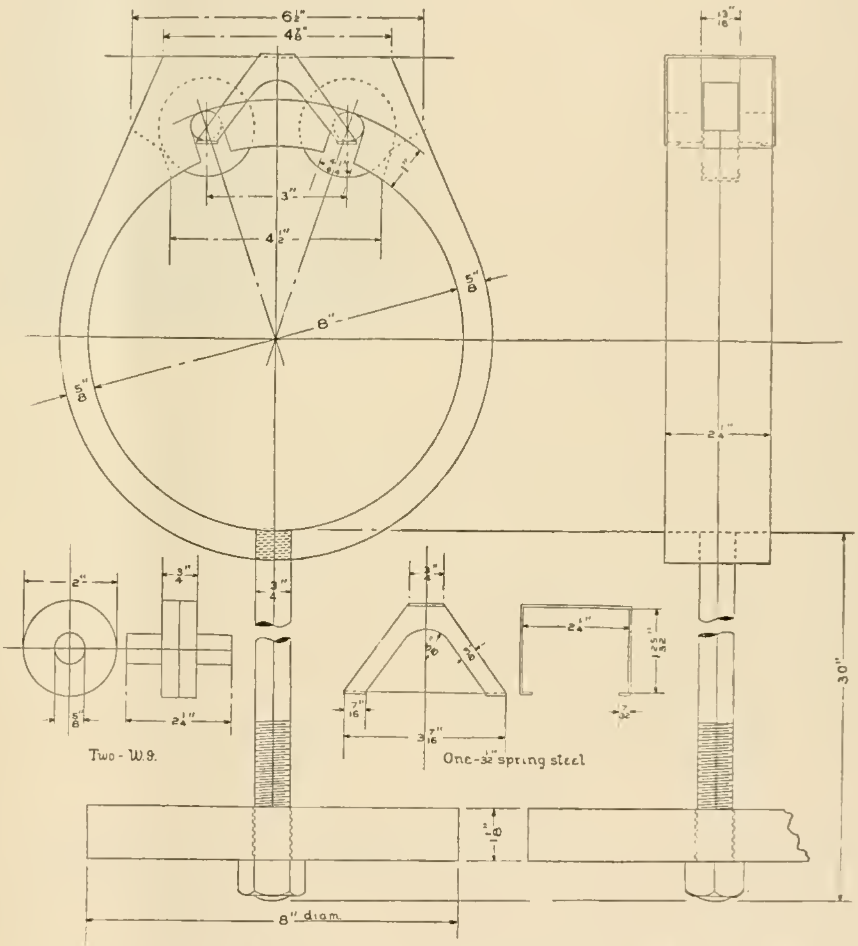
Counterbalancing to a reasonably correct degree, however, while the engine is undergoing repairs, is so easy and simple, and the financial returns so great, that it is only surprising that it does not receive more attention. It materially decreases the broken frames, springs, etc., and increases the mileage between general repairs, besides giving the engineer a new lease of life. The relief which it returns to a shop which is pushed for repairs as compared to the work and time required is very noticeable.

For the information of those who have not practiced any system we may say that the data required is as follows:

Weight of one piston complete; one crosshead complete with pin; each end of main rod; each end of side rod for eight-wheel engines or of each end and each wheel connection for engines having 6, 8 or more connections.

The weighing of the main rods is done by putting one end of the complete rod on the scale platform supported on a narrow strip of iron placed carefully under and across the center of the main bearing at right angles to the rod, while the rod is supported at the other end on a similar strip on a block of wood and the rod leveled before weighing. Then after weighing one end reverse the rod and weigh the other end in the same manner. The sum of these weighings should equal the total weight of the complete rod. The side rod is weighed in the same manner, and if it is a side rod for a ten-wheel or consolidation engine, the whole rod should be coupled together and each connection weighed similarly. The rods of engines with 6 or 8 driving wheels should be placed on edge to allow joints to move freely.

We now come to the weighing of the balance weight in the driving wheels. When the wheels are fitted up, the balance weight has to be in excess of the unbalanced part of the crank together with the crank pin, and it is this amount of excess which has to be ascertained; that is, the effect of this excess at the radius of the crank pin. Probably the common method is the best method of suspending the wheels, viz., to place each pair of wheels on a pair of level rails supported on trestles, rails to be planed perfectly straight and the wheels resting on the journals of the axle so that they may be rolled freely. Then to get the weight a yoke with friction rollers and provided with a rod and plate, as shown in sketch, is placed upon the crank pin on one side, and bars of iron of convenient shape are hung on the rod, the bottom bar should be long and narrow, about 8 ins. wide by 3 ft. long so as to clear the wheel and carry the additional weight required. Sufficient weight is then hung on to bring the crank pin down to the center of the axle, the wheels should be rolled gently either way and the load adjusted until the crank pin stops almost exactly on the horizontal line from the axle, or swings equally above and below that line. The half-tone shows a pair of wheels balanced and a stick marked with the distance from the floor to the center of the axle standing against the crank pin. The yoke is exactly behind this stick. The yoke, rod, and all suspended weights should then be weighed. If this does not correspond to the amount calculated then the counterbalance should be altered to suit.



DETAILS OF ROLLING YOKE, USED FOR WEIGHING COUNTERBALANCES.

When it is required to calculate the amount of counterbalance, it is always estimated at the radius of the crank The weights to be balanced (over and above those already mentioned as part of the wheel, viz., the crank pin and unbalanced crank) are divided into two sections, (1) the reciprocating weights; that is, the piston and rod, crosshead and pin, and the small end of the main rod; and (2) the revolving weights; that is, the large end of the main rod, and the side rods. Those in section (1) or the reciprocating weights, are added together and two-thirds of this sum taken (call this A) to be counterbalanced. This amount A is divided into as many parts as there are driving wheels on one side of the engine and added to the revolving weight to be found for each wheel.

The revolving weight for each wheel (except the main) is only the weight of side rod carried by that wheel, and which has been found by weighing. On the main wheel there is the weight of side rod and the big end of the main rod.

The following statement shows the result of weighing a consolidation engine:

RECIPROCATING WEIGHTS.

	Lbs.
Piston and rod	525
Crosshead and pin	232
Little end main rod	239
	996

$996 \times 2/3 = 664$ lbs. (A)

For a consolidation engine, $\frac{664}{4} = 166$ lbs. per wheel.

REVOLVING WEIGHTS.

	Leading. Lbs.	Intermediate. Lbs.	Driving. Lbs.	Trailing. Lbs.
Side rod	97	231	284	99
¼A	166	166	166	166
			big end 485	
	263	397	935	265

Wheel.	Wt. Req'd.	Wt. Found.	Difference.
LL	263	218	—45
LI	397	181	—216
LD	935	497	—438
LT	265	208	—57

Total shortage, 756.

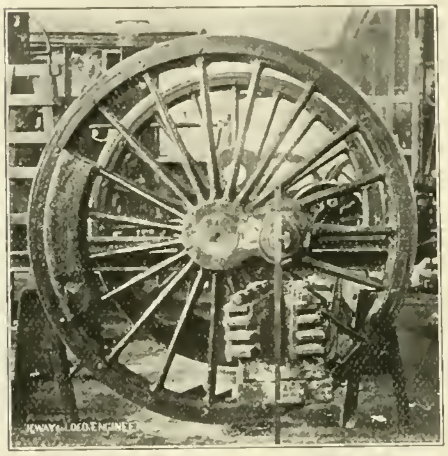
Wheel.	Wt. Req'd.	Wt. Found.	Difference.
RL	263	197	—66
RI	397	147	—250
RD	935	568	—367
RT	265	198	—67

Total shortage, 750.

Thus we have an unbalanced weight of about 750 lbs. on each side of the engine at the radius of the crank.

This engine had 56 in. driving wheels and 14 in. crank, and the wheels were so designed that nothing could be added to the thickness of the main and intermediate balance weights, which shows the importance of designing the wheel centers with sufficient balance weight capacity where it can be obtained. This, however, cannot always be done, and seldom, if ever, for the main wheel. However, under these conditions, a little overweight may be got into the leading, intermediate and trailing wheels which will materially improve the engine as a whole. The only method of adding weight when required to an engine in shop is by filling up any unfilled spaces in the counterweight with lead, and by fitting plates of cast iron or, preferably, wrought iron or steel to the counterweight on the inside or the outside, drilling through the weight and plate and securing by rivets countersunk on both sides. Care must be taken with inside plates to keep clear of the spring saddle and axle box, and on the outside clear of the side rods.

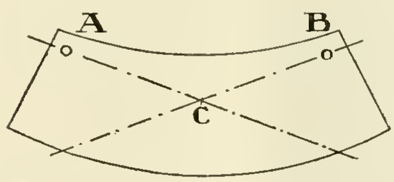
A practical method of ascertaining the thickness of plate required is as follows: Cut out of sheet iron ⅛ in. thick a template of the size and shape of the balance weight, thus, and drill two $\frac{3}{16}$ holes in it at A and B. Hang it up on a wire nail driven into a post so that it hangs freely by hole A, and in front of it hang a plumbob or nut by a piece of string which has been chalked. When it is perfectly steady, snap the string against it and make a chalk line on it. Do the same for the other hole, B, and the crossing of the two lines (which should be marked C) gives the center of gravity of the plate as shown by dotted lines on sketch. Now place the plate against the balance weight on the wheel and measure the distance from the center of the axle to the center of gravity of the plate. Suppose this to be 19 ins. and the crank to be 14 ins. Then if the amount required at the crank is, say, 75 lbs., we get $\frac{75 \times 14}{19} = 55$ lbs., the weight of the plate required. Now weigh the template, and suppose it to weigh 9 lbs., then $55/9 = 6$ nearly, which gives the thickness of plate required in eighths of an inch, or $6/8$ in. $= ¾$ in. thick. The plate is then cut out and clamped on the wheel and the rivet holes marked (about two for each space), drilled



WEIGHING THE COUNTERBALANCE.

through plate and weight, countersunk on outside of both and riveted up. If the weight is overestimated some of the lead may be drilled out easily to get carefully adjusted weight. The lead pockets should always be screw plugged to prevent loss of lead.

The following form for the counterbalancing of an engine with six



TEMPLATE OF COUNTERBALANCE PLATE.

drivers, after being adjusted, clearly shows the method:

Eng. No. .... Date ....

Counterbalancing.

RECIPROCATING WEIGHTS.

	Lbs.
Piston and rod	429
Crosshead and pin	364
Little end main rod	188
	3÷981
	327
	3÷654=A
	218 weight per wheel.

REVOLVING WEIGHTS.

	Leading. Lbs.	Driving. Lbs.	Trailing. Lbs.
Part side rod	114	292	114
A	218	218	218
		big end 336	
	332	846	332

Wheel.	Wt. Req'd.	Wt. Found.	Difference.
LL	332	332	0
RL	332	332	0
LD	846	847	+1
RD	846	848	+2
LT	332	332	0
RT	332	332	0

ROGER ATKINSON.

Electric vs. Steam Locomotive.

I am inclosing a cutting from the Montreal *Daily Star* of November 17, 1904, which may be of interest to you or your readers. This is considered one of the most reliable papers in Canada, and were it on any other subject it is possible I would take an equally extraordinary statement as gospel.

The account of the races with the light engines with a flying start seems to need quite a stretch of my imagination, and much more so where the race with the engine Mohawk is described. In fact, it is a stretch that it is altogether unable to take. Can you give me a description of this engine?

The part that, of course, lays the whole matter open to doubt is the last paragraph, where it states that in the race where it had 600 tons, and that apparently when opposed to the Mohawk, it attained a speed of 55 miles an hour. We never captured any world's records down here, but if the light engine was beaten without attaining a speed of over 55 miles an hour she would be a hopeless case with a train, and I think the New York Central Railroad would possibly make a better showing than that with one of our switch engines. That is the part I cannot credit any more than that the engine was beaten without a train by one with nine cars. We certainly do not have any passenger engines on this road that would retire at that degree of speed.

Hoping to see something regarding this test in an early issue of your magazine, Yours truly,

GARNET L. ORD,
Loco. Engineer, Can. Pac. R. R.
McAdam Jct., N. B.

[The newspaper item referred to by our correspondent was a press dispatch from Elmira, N. Y. The particular paragraph to which Mr. Ord takes exception reads as follows:

"Another pretty race was between the electric locomotive and the New York Central engine Mohawk. It was the closest of the day. Nine heavy cars were attached to the electric locomotive, while the Mohawk was run alone. For the first two miles neither could gain, but as the racers neared the sub-station the electric locomotive slowly pulled ahead and gained so rapidly that despite the heavy train behind it, the steam engine gave up the race after another mile had been run."—ED.]

Perhaps it's a good thing to have an unsound hobby ridden hard; for it is sooner ridden to death.—*David Copperfield.*

Big Four Economizers.

The term economizers is as appropriately applied to Mr. F. J. Zerbee, master mechanic of the Big Four, at Bellefontaine, Ohio, and his department foreman and employees as to the labor-saving tools which they are encouraged to invent and for which the company gives them due credit.

In a recent tour of the Bellefontaine shops I saw a number of tools in operation which deserve more than passing notice, and which, by kindness of Mr. Zerbee, we are enabled to illustrate for the benefit of our readers.

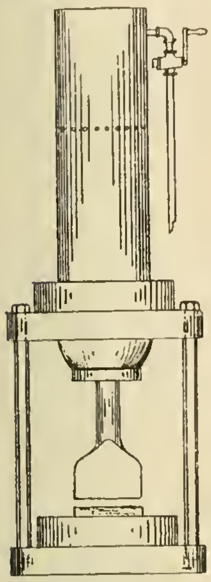


Fig. 1. AIR CHISEL CLIPPER

Fig. 2. Fig. 3. DRILL FOR FLUE SHEETS AND CHUCK FOR SAME.

Fig. 1 shows a small air chisel clipper for cutting off the chisel point after it has been drawn out and just before it is tempered. The machine is made with a double cylinder, the inner cylinder acting as a cushion for the piston in its downward stroke, relieving the shock and assisting the spring to return the piston to its normal position. This machine does very rapid and effective work and makes a clean-cut job.

Fig. 2 shows a retired twist drill put into active service again. The cut shows a 2 in. drill with its point turned down to ⅝ in. The device is used exclusively for drilling holes in flue sheets and on an average it drills 22 holes per hour.

Fig. 3 illustrates a chuck for holding twist drills where the tang or square part has been broken off, rendering the tool otherwise worthless. The cut shows a small latch secured by a set screw to the chuck, and as the latch is made of spring steel, it permits of sufficient deflection to engage or disengage the tool, which has a slot milled into it for the reception of the latch.

Fig. 4 is a device for removing scale from flues of greater length than can be accommodated by the rattler. As the flue passes through a 3 in. pipe, shown on the right, it engages with two small rollers set at an incline which grip the flue and force it to the three large rollers. These large rollers are so nicely designed that, unlike most rollers, they do not cut or leave ridges in the flue. The flues come out clean and brightly polished. The machine is very speedy, cleaning on an average a 16 ft. tube every two minutes.

Besides admiring these labor-saving devices, one cannot help but notice how scrupulously clean the shops are kept. There is an entire absence of litter from the floors. There is no time wasted in looking for the tools wanted. There is a place for everything and everything is in its appointed place.

Jos. A. Baker.

A Strenuous Week in One Shop.

There are two things a foreman has to contend with in railroad work that becomes a serious problem sometimes when work is pushing and help is short, and one of them is the lusher, who knows how, but is too befuddled to do a decent job, and the other is the man who began his career as a shoer of mules and oxen and perhaps just came out of a shop, size, 6x8, and the full extent of his knowledge on engine work consists in knowing how to sharpen a coal pick and split old ties, kindling size, to start the fires with.

Some of his town cousins have perhaps informed him that the shop needs blacksmiths very bad and that is enough for him, and, withal, being a hustler, he is over to the shop in two hops and a jump and offered you a chew of tobacco and shook your arm nearly off before you have time to ask him what he is there for and he informs you he is a blacksmith, learned his trade at the Baldwin Works and just came West to see his relatives and intends to stay if he can get a job that suits him. We size him up and look around at the empty fires and the work piled shoulder high and decide to try him and tell him to come on in the morning; in the meantime, I stroll around to see how P. Bolivar is getting along with a rocker arm that we are in a hurry for, and making the good, old-fashioned way, as our hammerman is under the weather and has just a slight attack of thirst which it will take some days to assuage. The aforesaid hammerman is a crackerjack when in working trim and a star on forging rocker arms, making them from the solid piece and all under the hammer and heating the pieces in the furnace, and as the process is interesting and not extensively used, a description would not be out of place.

Fig. 1 shows the blank of round iron, about 1 in. larger than finished size and of suitable length. Fig. 2 shows the first operation. Fig. 3 shows the piece ready for bending. After being bent, as in Fig. 4, it is ready for the finishing die, and it does the work nicely. Fig. 5 shows this die, and Fig. 6 two views of the rocker arm as it comes from the die, after being set accurately—that is, the angle of the arms to each other—it is taken to a blacksmith to have the arms cut to length and the bosses finished, and it is ready for machining. Plenty of stock is left for the machining, as it is comparatively easy to take it off with high speed machines and steel and heavy cuts.

Now, our friend, Bolivar, being a very good workman and capable of doing a good job when payday had come and gone about three weeks—but as payday had just been around and Pat had drawn a very fair and fat stipend for services rendered and he and John Barleycorn were promenading arm in arm, I kept a close eye on him in his efforts to finish the rocker arm. He had already upset one end of the shaft, as in Fig. 7, and was preparing to upset the other end when I was called away and had been detained by the man I had just hired, and strolled back to him and was knocked silly by what I saw. Pat, having difficulty in holding the shaft, had looked around for something to help him hold it and his eyes fell on a big swage block lying near the face plate and it happened there was a hole in the block just large enough for the piece. So Pat has the block put on the face plate and heats the unfinished end and when ready takes the piece and puts it in the block, turns it over on the plate and proceeds to upset the other end, and had just about finished the job when I came up and ordered him to take the piece out of the block. Of course, he could not, as both ends were upset and riveted in the

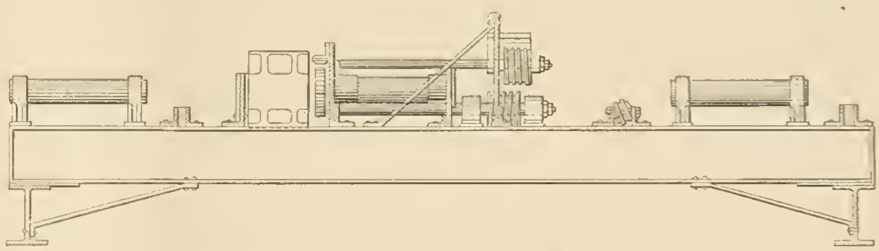
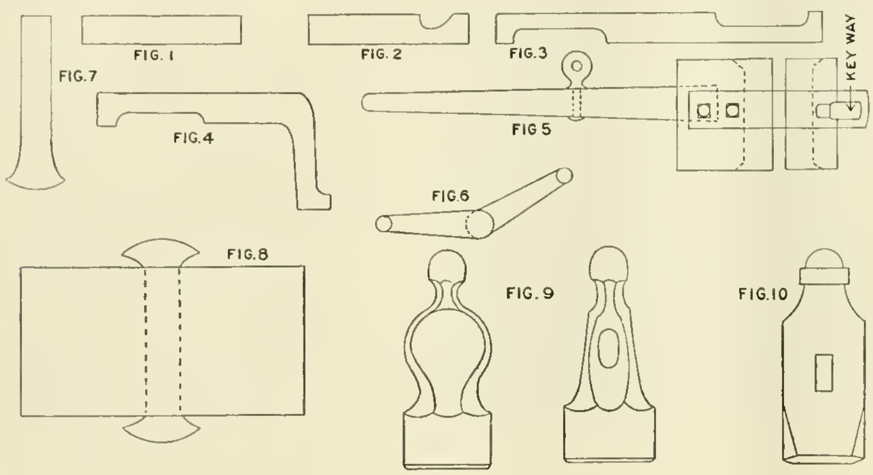


Fig. 4. LONG FLUE CUTTING MACHINE.

block tight, and as the iron was 5½ ins. diameter, it was there for keeps. Fig. 8 shows how it looked.

I had to let P. Bolivar recuperate for a few days and cut the shaft out of the block and charged the loss to P. Bolivar, Esquire, which reduced his supply of shekels the next payday and was the means thereby of keeping him sober for a longer period than was his habit.

Our new man from the Baldwin Works came in and went to work making some tools for himself, while I had to jump in and finish the rocker arm, that the M. M. was having seven kinds of fits



T. TOOT'S TOOLS AND SHOP APPLIANCES.

about. I did not have much of a chance to see what our Philadelphia friend was doing until late in the evening.

He had been putting in the time manufacturing himself a hand hammer, and of all the hammers I have ever seen in my long and varied career this particular one eclipsed anything that it has ever been my lot to see.

Now it happens that I am a crank on the forging of a hand hammer and love to see a well proportioned and well balanced hammer and have made some nice ones in my time, and Fig. 9 shows two views of such a hammer as I usually make, and annealing it carefully after forging so the strains are all equalized before tempering.

It is almost beyond my capacity to depict the thing that the man from Quakertown had constructed, but Fig. 10 shows it as near as I can come to it. It will be noticed there is a band around the neck of it. This may be thought to answer some useful purpose, and I was at a loss to think what it was there for until the Baldwin man informed me that the pein had jumped off on him after he had made it and he had taken this means to weld it on again, and the funny part of it was that it stuck good and tight; no one but a botch would have ever attempted such a job, and a smith to make a tight job of such a thing must be as lucky as the man that fell in the river and came to the surface with his pockets filled with gold fish.

I advised my new acquaintance to hie himself back to the East, as his mode of workmanship and design was entirely too complicated for our slow-going shop. The hammer I kept in the office to scare away the rats and mice, and it did the work as well as a Chinese scarecrow could have done it. Our country is certainly worthy of being classed as nervy when such men are allowed to go free and untrammeled about the land and impose on a confiding railroad company.

It might be thought that for one week's mishaps my cup was full to overflowing, but as I had a German of large head and small brains that constantly exhaled a delicious odor of Limburg cheese and stale beer, he was the next to make a break, and in a peculiar way that only a Dutchman could contrive to make.

I gave him an order for 500 pieces ¾x2½x13 ins. long for 2-hole brake jaws, and he proceeded to cut them off and was stacking them up when I came around. The pieces looked short to me, and picking one up, I measured it and found it was just 11 ins. long, and called his attention to it. He looked at my rule and said: "Poss, you haf your rule hind side foremost; you measure him de oder vay," and, suiting the action to the words, he turned my rule end for end and it did measure 13 ins., but, of course, it was commencing at the 24th inch and running back to 13 on the rule. It totaled 11 ins. and I had quite a time convincing him of his error. It never rains but it pours, and this was a cloudburst. Words could not express my feelings, but they were near the breaking strain, and what can one say to a man who is generally a good worker and faithful, but gets an idea in his thick nut sometimes that no amount of talk can dissipate. And this fits his case exactly.

Every cloud has a silvery lining, and I had the satisfaction of perfecting a truck for handling couplers that proved to be very handy and made quite a saving, as one man could handle more couplers with this truck than two could handle by hand, whether the yokes are on or off. Fig. 11 shows the handle and carrier, side and flat view. Fig. 12 the axle. Fig. 13 the pins to hold the coupler in place on the truck. It saves a great deal of time and labor, for we repaired a great many couplers in our shop and had quite a distance to get them in and out of the shop. The M. M. ordered four of them for yard use which encouraged me to think that I had not lived in vain that week, notwithstanding the efforts of P. Bolivar & Co. to make me think otherwise.

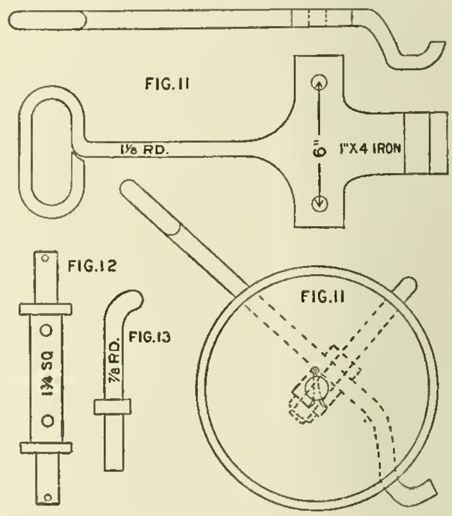
T. TOOT.

St. Louis Mo.

Observations and Suggestions Concerning the Electric Locomotive.

The Berlin-Zossen high speed electric car experiments suggest reduction of air resistance in order to secure speed increase. To do this lower the car roof so that a tall man may just walk under it with his hat off. Narrow the aisle to its minimum width and save that on the width of the car.

Lower the car between the trucks so that it will just safely clear the track. Where it rests upon the trucks being too low for passengers, place the transformer, compressor, tank, accumulators and brake cylinders, etc. The end be-



COUPLER CARRIAGE.

yond the truck, lower down close to the rails for a motorman's triangular cab, cow-catcher like. In case of side sway duplicate under the truck the side bearing plates above it, extending to them a pair of steel sills from under the depressed car.

Such construction would admit of larger wheels, of firmer grip and reduced axle friction.

J. F. HARTMANN.

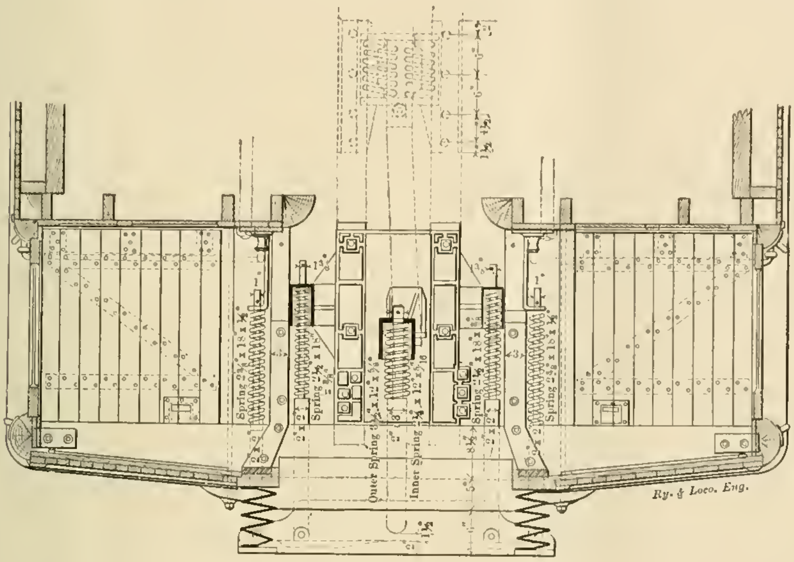
Providence, R. I.

A Non-Telescoping Platform.

Readers of Railway and Locomotive Engineering will be interested to learn that a platform has been invented which guarantees to prevent the telescoping of day coaches so frequently mentioned of late in the reports of accidents and collisions.

Uusally the heavy Pullmans on the rear of the train by their great weight add to the destruction of the lighter day coaches after the impact of a collision has taken place, so that it is almost miraculous if any of the coach passengers come out alive.

Our illustrations show a malleable iron platform and buffing device which has been patented by Mr. C. Coller, master car builder of the Monon, and since its adoption by that road some time ago the cost of repairs to platforms and draft gear has been reduced 80 per cent.



COLE'S NON-TELESCOPING PLATFORM.

The engraving shows it as applied to the vestibule type. The platform main casting is made in one piece with suitable pockets cast on to it for receiving outside buffer springs. The pocket that receives the spring for the center buffer stem is made in a separate piece. This casting straddles over the coupler shank, with the flanges extending down on each side of shank. There is a key of ¾ in. by 4 in. iron passing through the flanges and through the coupler shank. The footplate has bosses cast on the top side for the handrail columns to screw into instead of passing through the platform and sill. This allows the flange of the buffing plate to be extended the full width of the buffer plate, which affords a wider passageway from one coach to another and prevents an opening whereby passengers might catch their feet. On vestibule cars this foot and buffer plate extends the full width of the vestibule opening. The main platform casting being very strong and having such a wide bearing surface against the end sill of body and platform prevents the danger of crushing the platforms when in collision and practically overcomes the danger of telescoping.

The purpose of the center casting attached to the coupler shank is to keep the face plates always in contact, for the harder the pull on the coupling the closer the face plates are pulled together.

Another excellent feature—should the coupler pocket become broken or disengaged at rear of shank—the coupler cannot pull out, as this center casting will come in contact with head block and prevent coupler from pulling out.

This platform and buffing device has been applied to 75 passenger cars and 50 engine tanks on the Monon and is giving the most gratifying results.

J. A. B.

Safety Valves on Tank Cars.

On page 558 of your December issue is an article on the subject of tests of safety valves for tank cars, in connection with which is shown the frangible disk used on cars carrying ammonia and other similar liquids.

This may mislead some of your readers to think that the form shown is the one experimented on at Lima, Ohio, but the fact is that the valve so tested was the regular spring loaded valve illustrated in the Master Car Builders' Association Proceedings of 1903, and this valve proved itself to be admirably suited to relieving tanks of internal pressure.

The frangible disk arrangement which you show in connection with your article, was designed for relieving the pressure on tanks carrying ammonia and such liquids where no escape of vapor can be permitted except in the case of fire. Consequently, the lead diaphragm arrangement shown was tried by the Solvay Process Company, and, upon repeated tests, it was found that the lead seal ruptured at a point very near the desired pressure. Of course, after the seal is once ruptured, the volatile contents of the tank will be vaporized.

Yours truly,

A. W. Gibbs,

General Supt. Motive Power P. R. R.

The "Big Stick" in Railroad Operation.

Some people in Canada appear to have taken President Roosevelt's "big stick" in earnest, for there is an electric railway in Montreal, which insures safety of operation along a stretch of single track in a very effective and at the same time inexpensive way.

The railway has a double track except for one short stretch where it crosses the Lachine canal and the water basins near the St. Gabriel locks. This portion is carried on a bridge and there is only a single line of rails on the structure. In addition to this, the road on the bridge is crooked and the view ahead is necessarily restricted.

The possibility of mishap or accident is removed by a regulation of the company, which provides that the only car having right of way on the bridge is the one carrying a "big stick." This is in reality nothing less than a painted baton about a foot long and a car having the right to cross receives this stick and proceeds, the conductor gives it to the man in charge of the car waiting at the end of the bridge to go in the opposite direction, and this man carries it over the bridge and retains it until he meets a car moving toward the bridge. Thus, this one stick is kept constantly in use regulating the bridge traffic.

The system here outlined is in essence and in principle the train staff system, and while it ensures safety of operation it does not easily provide for continuous movement in one direction, but where safety is, as it ought to be, the first consideration, this crude staff system is all right.

Not long ago President Roosevelt advised people to "talk softly but carry a big stick," and the Montreal electric road adopts something like this strenuous advice when it compels its employees to run cautiously and carry a big stick when on the Lachine canal bridge.

H.

White brass is a metal that is used considerably by railway companies, but it is an article of the whited sepulcher order. It is an article of the nasty cheapness character posing under a false guise of respectability. The ordinary kind consist of 68 per cent. of tin, 31.5 per cent. of zinc, 1 per cent. of copper and 0.5 per cent. of lead.

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A Safe and Sane Railway Policy.

No more weighty words were ever uttered in the council chambers of this nation than those of President Roosevelt, which are to be found in his recent message to Congress. In dealing with the loss of life on our railroads he has plainly stated what he considers to be the four essentials which should be embodied in the railroad legislation of the immediate future. They are, briefly, the compulsory adoption of the block system of railway signaling, the enforced limitation of the hours of continuous railway service, the employment of trained and experienced men only in positions of responsibility, and the severe punishment of all those who, by the issuance of wrong orders, or of those who by the disobedience of orders, cause disaster.

It is a matter of common knowledge that in thus advocating the adoption of block system the President is voicing the sentiment of the public at large who have become appalled at the loss of life due to what is generally believed to be preventable accidents. That this idea is well founded may be gathered from some recently published statistics concerning the principal railroad wrecks in the United States for the first nine and a half months of 1904. Eliminating failures of equipment, there were 18 wrecks caused by want of proper signals or the disregard of danger indications. In these disasters 171 people were killed and 484 were injured.

Statisticians and special pleaders may prove that these figures are not so high as those of other years, or they may ring the changes on the percentage due to this kind of human failure or that kind of disobedience. The sober and saddening fact, nevertheless, remains, that if the causes which have operated in the past operate in the future in the same proportion, there are in this land now alive, and in the full enjoyment of the glad New Year season, over 200 persons who will, during 1905, meet violent and shocking deaths on railroads and more than 600 who will be maimed and mutilated in the same time.

With regard to the advisability of restricting the hours of service, no thinking man, be he railroad manager or employee, will seriously quarrel. There is a limit to human endurance, and a deadening of the faculties follows prolonged continuous strain. Ignoring these facts of Nature introduces a danger in railroad operation which not only the traveling public but the conscientious employee who is doing his duty and who expects that others shall be capable of doing theirs has a right to see reduced to its very lowest terms.

The employment of trained and experienced men in railroad service is in line with what is done in the army and navy, and no critic of our land or sea forces has ever ventured to find fault with systematic training or with the reward, by advancement, of competent and capable men.

The desire of the President to see legal means provided for the adequate punishment of clearly proved railroad delinquents will, if carried out, have a very salutory effect upon the kind of man whom we have before now called the "Chancetaker." This man, whether he runs past a danger signal or whether he permits discipline on his division to grow dangerously lax, or even in an indirect way jeopardizes the lives of others, has no legitimate place on any railway to-day, and the successful singling out of him will be for the general good, and, in the words of St. Peter, it will be done "for the punishment of evildoers, and for the praise of them that do well."

Where the Majority Really Rules.

There are fears in some quarters that the unreasonable demands of organized labor will eventually ruin this great country and throw our progressing civilization into anarchy. Some sections of organized labor have at times been very unreasonable, but that was a very small portion of the whole and merely created local disturbances of business. The ordinary press is so much on the side of capital that it is very rare to see the subversive actions of organized capital denounced even when things are done that grind into dust the interests of small capital and of labor, things that are much more dangerous to the stability of our institutions than anything ever tried by wage earners.

What organized labor may be expected to do when it combines politically may be predicted from what it has done in New Zealand, where it rules the country. An address was recently delivered by Prof. Frank Parsons on the contrasts between New Zealand and the United States, which indicates that New Zealanders have obtained rights and privileges which the most progressive statesmen have been demanding in vain for the United States and the country thrives on the fair-play given to the whole of the community. Part of Mr. Parsons' address reads:

In New Zealand organized labor uses the ballot to accomplish its ends, but in America the workingmen carefully refrain, for the most part, from using this greatest of all the powers they possess.

The capitalists have stood together in the United States, but the farmers and workingmen and small merchants and manufacturers have divided. In New Zealand the capitalists have stood together, but the workers and farmers have stood together also, and have carried the day against the capitalists. The agricultural population forms about 40 per cent. of the total population in New Zealand, and the farmers have 40 per cent. of the representatives in the national house, without considering the Maoris, who are all rural. In the United States the agricultural population is also about 40 per cent. of the total, but has only 9 per cent. of the national representatives. On the other hand, the lawyers have only a small representation in the New Zealand House, and a very large one in our Congress and legislatures—12 per cent. in New Zealand, against 60 per cent. in our Congress and some of our legislatures. Our organization is for private profit and industrial conquest; hers is for justice and public service. We have a National Labor Bureau and an able Commissioner, but the department is generally limited to the publication of statistics. In New Zealand the principal duty of the department is to find employment for the unemployed and improve the condition of labor, the publication of statistics being a subordinate function.

New Zealand has a parcels post that will carry a parcel three feet long and three feet in girth and weighing eleven pounds or less, all over the world for 12 cents a pound, or six cents inside the colony. The United States has no parcels post for inland service, and no foreign service except with New Zealand and a few other countries.

New Zealand has postal savings banks, and the total deposits in all sorts of banks amount to $140 for each inhabitant. The United States has no postal savings banks, and the total bank deposits amount to only $110 per inhabitant. The State telegraphs of New Zealand transmit five messages per capita each year, while the private telegraphs of the United States transmit not quite one message per head of the population. New Zealand makes a good profit on her postal business.

Here the railways are managed for private profit; there railways are run for public service. New Zealand has an eight-hour day and a half-holiday. We have, as a rule, a ten-hour day and no half-holiday. With us the aged and destitute must depend on charity or go to the pauper house. In New Zealand the aged poor receive State annuities.

It is estimated that strikes and lockouts in the United States have cost employers and employed $380,000,000 in the fifteen years, 1887 to 1902—or an average of $25,000.000 a year. The total cost, including the public loss, is probably not less than $600,000,000, or $40,000,000 a year. New Zealand also had terribly expensive strikes before she got her arbitration court, but in the ten years since then she has been practically free from industrial war. Of course, New Zealand has abolished the legal fiction in common law that every man is familiar with the habits of all fellow servants and is guilty of contributory negligence when he receives injuries from the carelessness of a fellow servant he has never seen.

Inventors and Poets.

An inventor is generally looked upon as a hard headed, matter of fact person with none of the celestial fire that produce the great works of poets and immortal writers. Yet a little reflection will convince mental analysts that the mental attributes which produce the works of a Milton or a Shakespeare are similar to the mental forces which have invented the printing press, the steam engine, the electric dynamo, the telephone and the air brake. In his anecdotes of Steam Engines, Robert Stuart discusses this subject in the following interesting fashion:

"On reflection it will be found that mechanical invention differs nothing from that which gives value to those pursuits, considered to be more mental and refined. Homer and his Iliad, Virgil and his Æneid, Milton and his Paradise Lost, were minds and productions of the same exquisite fiber and tension with Savery and Watt with their engines, Huyghens with his watch, Arkwright with his spinning frame, and Bramah with his hydraulic press. In fact, all observation shows that the power of combining machines and constructing poems, in the 'heroic or any other line,' are usually united in the same individual, that all poets are mechanical inventors, and all mechanical inventors are poets. Hooke made verses as well as machines; and when he presented thirty-seven different projects for flying, had his attention been directed to express his thoughts in meter, he had previously shown a facility for describing the glories of his mistress' eyebrows in as many sonnets. Lord Worcester also made verses, and his 'Century of Inventions' has been commented upon my more than one person, as if it were a poem, although not written in rhyme. Sir Samuel Morland indited love-songs, and sang them to his theorbo. When total blindness had fallen on the jovial old man, he buried the manuscript of the effusions of his younger muse, considering them to be 'gay deceits,' and betook himself in his ninetieth year to the composition of psalms. Arkwright was famed among his customers for a light hand and exquisite edge, and for verses which cut as keen as his razors. Watt, in his youth, was a rhymster, and few men of his generation read more fairy tales and poetry —even in the meridian of his life, and in the busiest period of his employment, the greater portion of his time was devoted to indulgence in this mental luxury. Few who knew the excellent Rennie near the close of his life would have dreamt of finding under his inflexible man of business exterior, an enthusiastic admirer of poetry and music; or, that in his youth, he chanted his own lyrics, which were distinguished for their spirit and taste. His contemporary, the venerable Telford, when building rough stone fence walls as a journeyman mason, was an esteemed contributor to the poetical corner of the Scots' Magazine— and his productions were imbued with much of the pastoral sweetness and pathos of those of the Bard of Ayr. Sir William Congreve let off many poetical squibs before he exploded his rockets. Sir Christopher Wren is complimented by a bishop on his poetical acquirements: 'You have,' says the Right Reverend Father in God, 'admirably well hit his genius; your verse is harmonious, your philosophy very instructing for life, your liberty in translating enough to make it seem to be an English original, and yet not so much but that the mind of the author is still religiously preserved.' Could more be said of the paraphrases of Dryden or Pope? One of the ablest disciples of Sir Humphrey Davy hazarded the opinion that some of the expresident's speculations 'graduated into the poetry of science.' The devotee was ignorant of his idol's early propensities, and he knew not that Sir Humphrey wooed the muses before he experimented on the gases, and produced, 'in the heroic measure,' his address to St. Michael's Mount, long before he invented the safety lamp. Dr. Cartwright early distinguished himself for his poetical compositions; but the fine taste and exalted feeling which pervade them must yield to the exquisite invention and extensive usefulness of his power-loom."

Government Supervision, Not Ownership.

In 1901 Congress passed an act requiring interstate railroads to make monthly reports of all accidents to passengers and employees on duty. At the present time President Roosevelt has called the attention of Congress, through the medium of his annual message, to the advisability of enlarging the powers of the Interstate Commission, so that a government investigation of all railroad accidents which involve loss of life can be made, and that the results of such investigation shall be made public.

Railway supervision by the government, not government ownership, has long been known in Great Britain, where the Railway Department of the Board of Trade inspects the equipment of all new railroads and conducts an impartial investigation into all railway accidents which happen in the United Kingdom, and, generally speaking, exercises such supervision over the operation and traffic of railways as is deemed to be expedient in the public interest. The Board of Trade is a government department. the president of which has a seat in parliament. The Board is divided into a number of sections severally dealing with all merchant shipping, lighthouses, harbors, mercantile corporations, railway and tramway traffic, etc. The chief inspecting officer for the railway department is Col. H. A. Yorke, who is well known on this side of the Atlantic, having made a critical examination of our railway systems last year.

The creation of an independent and non-political railway commission in Canada about a year ago by the government of the Dominion, the Commission having powers similar to those of the Railway Department of the British Board of Trade, indicates the growth of the idea of government supervision in railway matters. Canada lately rejected at the polls the idea of government ownership while maintaining government supervision.

Such supervision as we speak of, controlled by competent officers, is not necessarily oppressive in its operation, and it is distinctly in the public interest It has a tendency toward uniformity of practice and it is likely to raise the standard of railroad efficiency. The President's proposal to have the results of every investigation made public, a system repeatedly urged in these pages, is as wise as it will be beneficial. Government investigation will certainly get at the wholesome truth in each case, and the sooner the weak spots are revealed the sooner can the proper remedies be applied. The public are looking for some such governmental supervision as the President outlines. Other countries have it and like it. Why should not we?

Responsibility of the Locomotive Engineer.

It is quite common for daily newspapers, in writing up railway collisions, to chronicle the fact that the engineer "bravely stuck to his post, applied his air brakes and reversed his engine." A recent account, severely censures the engineer for leaving his engine as it plunged into a wreck, stigmatizing him as cowardly for so-doing, and draws a parallel between this ignoble (?) case and that of a brave naval commander going down with his sinking ship.

In a sentimental way, the spectacle of a commander going down with his stately ship, is beautiful to contemplate. This sentiment, however, is for men whose profession is to kill and whose lot is to die; but it has no connection with the locomotive engineer, a man of peace and custodian of passengers' lives.

While not undervaluing the commander's bravery and noble impulses in retaining companionship with his ill-fated ship, still, it is a matter of record that he does so only when rescue of his crew and self is impossible. A slowly sinking ship's crew is usually succored. A rapidly sinking vessel, however, seldom permits of full rescue, and the brave officer and men who go down deserve all honor and praise possible to bestow upon them. But when rescue is possible, it is seldom refused by a sane commander; and he should not be stigmatized for accepting it, after he is powerless to further save his ship. Likewise, a locomotive engineer, who has done all in his power to stop his train and avert disaster, should be permitted to retire if he can do so, and not be made to suffer the stigmatic sting of romantic and inexperienced young newspaper reporters for refusing to offer himself up a useless sacrifice.

There was once a fashion of fighting wherein a soldier stood boldly exposed in bright colored uniform, an inviting target to be shot down by the enemy. But fashion has changed. Neutral colored, inconspicuous uniforms are now worn, and available shelter is taken advantage of to protect the soldier. The change is better for the soldier and the cause he fights for. This regard for the lives of fighting men should be applicable in the case of the peaceful engineer, who seems popularly and senselessly supposed to be sacrificed when nothing whatever is to be gained by it.

To leave the engine requires time and opportunity, and often more nerve than to stay. At high speeds it is dangerous to leap, especially in the dark, and where footing is rough and uncertain. This fact has probably kept more men on engines than the desire to become heroes.

To leap at the first sight of collision is to ofttimes sustain fatal injuries, or to perchance chase the train after it has stopped and feel foolish at finding it stopped and the disaster averted. But after quickly and faithfully doing all that can be done to stop, the engineer and firemen are surely justified in jumping as late as their personal safety will permit.

A live, discriminating engineer, with the self-consciousness of having done faithfully all in his power to save his train before finally leaving his engine, is vastly more useful to his family and to his railroad than a dead hero, who is forgotten almost with the passing of the edition of the newspapers which glorify him.

The commander may love his ship and he may have no greater and nobler desire than to share her fortunes and fate; but sentimental ties are not sufficiently strong with the duty-performing locomotive engineer to draw him resignedly into sacrificial and useless death on a "pooled hog."

The Open Hearth Furnace a Picture of Creation.

Philosophers say that the operations witnessed in our open hearth furnace for the refining of iron display phenomena that resemble the action of forces which attended the cooling of the earth's surface at the time the globe was a molten mass.

In the furnace a metallic mixture of iron, silicon, carbon, sulphur, etc., is simply fused and exposed to the superficial action of atmospheric air. What is the result? Oxidation of the more oxidizable constituent takes place and these oxides at once arrange themselves according to their specific gravities. The oxidized carbon forms atmospheric matter and rises above all carbonic acid, then the oxidized silicon being lighter than iron floats above that and combines with aluminum or calcium that may have been in the pig and with some of the iron; thus forming a silicious crust closely resembling the predominating material of the earth's crust.

When the oxidation in the furnace is carried far enough the melted material is tapped out into a rectangular mold where it settles and cools. During this cooling the silicates which represent the rock matter, separate from the metallic matter and solidify on the surface as a thin crust, which behaves in a very interesting and instructive manner. At first a mere skin is formed. This gradually thickens, and as it thickens and cools, becomes corrugated into mountain chains and valleys much higher and deeper in proportion to the whole mass than the mountain chains and valleys of our planet. After this crust has thickened to a certain extent, volcanic action commences. Rifts, dykes and faults are formed by the shrinkage of the metal below and streams of lava are ejected. Here and there these lava streams accumulate around their vents and form isolated conical volcanic mountains with decided crators from which the eruption continues for some time. It is easy to conceive a parallel between this action of the furnace product as the stupendous operations attending creation.

Opposition to Mechanical Stokers.

We have been informed on what seems to be entirely reliable authority that locomotive firemen are opposed to automatic stokers and are working up combined and systematic opposition to the introduction of any kind of mechanical means of supplying the firebox with fuel. The locomotive firemen of the country form a very powerful and a very influential body; but they cannot afford to lend themselves to any movement which represents opposition to progress, and nothing is more badly needed to-day than an invention which will lighten the toil of firing heavy locomotives.

All through the history of the modern world since inventors began to devise appliances for lightening human and animal drudgery, there has been fears manifested by the laborers concerned that the labor-saving appliances would throw workers out of employment, but labor-saving devices have always had the opposite effect. There is no line of industry that has been stimulated by labor-saving appliances which has failed to put the operators in a more comfortable and better-paid position than they occupied when their work was done by hand.

The difficulty with workers who display fear of improvements devised to save labor is that they have not had the experience necessary to prove to them the increased demand that results that always come from stimulating production, and they have not sufficient knowledge of industrial history to acquire the lessons of past experience which teach that the employment of more people has always followed the introduction of labor-saving machinery in all industries. When the spinning jenny was invented its introduction caused riots in many parts of the textile world, and the labor leaders of the day predicted suffering and ruin to all who depended upon spinning for their livelihood. Instead of ruin came such prosperity as the trade had never before known, and the improvement was followed by the shortening of the hours of labor.

Fears similar to those suffered by the cotton spinners, over the introduction of improved machinery, were shared by blacksmiths when power tilt hammers were first brought into use. The stalwart men who performed the terrible toil of wielding huge hammers felt that a water wheel driven hammer would impart blows that no human strength could rival and meant ruin; but the sturdy hammer men became smiths that guided the glowing iron on the anvil, exchanging inhuman drudgery for a skill regulating occupation. Hard work that entailed little skill has always been the worst paid, but when machine operations crowded out hard labor the worker has invariable reaped the benefit of shorter hours and generally lighter toil. Probably there never was a harder worked and more miserably paid set of human beings than the seamstresses of London, whose misery moved Hood to write the Song of the Shirt. Other poets and humanitarians raised their voices and labored zealously to improve the condition of the suffering needlewomen, but their efforts bore little real fruit and the first effectual remedy arrived with the introduction of the sewing machine which might have been expected to make matters worse.

Coming down to railway operations, there are many men still alive who had to perform by chipping nearly all operations now done by planers and shapers. Does any one pretend that the machinist trade has languished because planers and shapers and turning lathes have taken upon themselves the hard toil formerly imposed upon the machinist? It is only about a decade since pneumatic tools were introduced into boiler shops, taking away a vast amount of the uninteresting drudgery formerly performed by human muscle, yet we do not find skilful boiler makers complaining through loss of employment. In most cases where hard work is changed from hand to machine, it means that light manipulating labor of a skilful character takes the place of heavy exacting toil.

When the introduction of mechanical stokers for the firing of locomotives and of steamboats becomes general, and it is bound to come sooner or later, the heavy work of the fireman will be exchanged for the skilful manipulation of a machine. There will be as many firemen needed as there are to-day, but they will become artisans instead of skilled laborers. There is a belief that the introduction of firing machines will cheapen the labors of a fireman, but as far as we can see it will have the opposite effect. To fire a modern heavy engine the principal requirement is brawn and strength. It will surely be an improvement to substitute intelligence instead of a coal heaver's ability.

Not Wanting to Help.

There are many points in old Gregor Graham's philosophy that are as much applicable to railroad men as they are to the people who work in packing houses. "Very few men," he says, "are worth wasting time on beyond a certain point and that point is soon reached with a fellow who doesn't show any signs of wanting to help."

That dictum applies particularly to the boy who enters an office or a shop and considers that the duty of looking after his own comfort requires him to do as little work as he possibly can. It applies to the young brakeman and the fireman, who is constantly haunted with the fear that he may do more things than his duty demands.

We have in mind a country boy, who got work in the repair shop of a railway where his father was a section hand, and was ambitious to have his son rise in the world. He was very green this youth and the other boys egged him on to be insubordinate to the foreman. For refusing to sweep out a pit he was kicked out of the shop. Ashamed to go home he hired out as cabin boy on a coasting schooner. He was hardly afloat when he told the mate that washing decks was not his work. A rope end well applied convinced him that he was there to do what he was told. Rope and discipline was endured frequently during the voyage, and the duty of obedience was duly impressed upon his person.

On getting back to the town where the shops were, this lad, who was sensible enough at bottom, was ready to eat humble pie, so he went and begged the foreman's pardon, who was a good-natured man, and took the boy back. He had received the needed lesson and concluded that he was employed to do what he was told. He is now locomotive superintendent of a railway in India, but he did not rise to that position by standing on fancied rights.

Modern Versus Primeval Transportation Facilities.

Less than a century ago, the only transportation facilities offered the traveler journeying from the lower end of Manhattan Island to the Harlem, aside from the stage coach and similar vehicles, was a solitary horse car line on the now famous New York Bowery. That line ended at what is now Canal street. Beyond that point to Harlem lay swampy and sparsely settled stretches, uninviting to the inhabitant of the "city," and that part of the distance was negotiated by stage coach only. The light iron rails of the car line were laid on sleepers of stone. The rumble of the little six-by-eight single horse car was heard once every half hour, if it was on time; but the schedule was seldom adhered to, as delays were frequent and of serious duration. The car was often stopped and the driver called on to assist a drover collect his frightened herd of cattle, bound for the Bowery market, from the track ahead before the car could proceed. The trip over the line consumed from three-quarters of an hour to two hours, according to the seriousness of the interference offered the car's transit.

To-day, Manhattan's citizen may travel from lower New York to the Harlem river in an electric motor car on any of a dozen different surface lines, forcing and clanging its way through thousands of heavily laden trucks and motor carts. If that mode of travel should be too slow for him, he can divert to any of the four elevated lines, and be stilted through the air, amongst the housetops, in much quicker time. Faster yet may he travel if he chooses the new subway; for there the huge, mole-like express trains, with powerful electric motors, will whisk him through the steel lined and steel pillared tunnel at the rate of forty-five, and even fifty, miles per hour.

Could the old Indian chief, who centuries ago stood on the south shore of the island and viewed with bitter disapproval the approach of the white-sailed ship of the foreign intruder, come to life and occupy his old view point, what a difference his gaze would behold! With the motor's hum and the pneumatic whistle's blast singing in his ears, and perhaps causing his brain to reel, he could be hurried to the site of his old camp on the Harlem in thirty minutes, instead of the six hours which it took him on a former occasion. Could he retain his level old head long enough to voice his impressions to his savage band of followers, amidst his amazing surroundings, he would undoubtedly give the white man credit for having made good use of the talents entrusted him by the Employer, and not laying them away, servant-like, hidden in a napkin.

Comfort of an Artificial Limb.

A source of amusement to our old friend, W. W. Thompson, who lost one of his feet and is now sporting an artificial limb, is the excuses of people who accidently tramp on his manufactured foot in street cars and other places. William will smilingly reply, make no apologies, you may stand on it as long as you feel like it, and then the intruder will stare. Losing a limb is no light matter, but there are times when artificial toes would be comfortable. When one has seated himself behind the curtain of a sleeping car and removed his shoes preliminary to undressing, and an unsteady passenger comes along and stamps a No. 14 boot upon both your feet the peace of the train community is preserved by the growing practice of people leaving their revolvers at home.

Steel Cars as Adapted for New England Railroads.

Metal cars in the United States are older than is generally known, though the first of any quantity were built in 1897. This interesting bit of information was given in the opening words of his paper, by Mr. John F. MacEnulty, when reading it at a recent meeting of the New England Railroad Club. Experiments have been made by men who appeared to be ahead of their time, and to-day we are often surprised to find in some out of the way corner a steel car of some queer design which probably made a stir in its own small world when it was new.

One of the largest railroad systems in the country, using between 20,000 and 30,000 steel cars, determined by actual experiment, that the steel entering into the construction of their cars, lost just 1/200 of an inch by corrosion in four years. As a result they have abandoned the idea of painting them. In New England the tendency has been to stick to all-wood construction, probably from the idea that steel is desirable only for high capacity cars.

One point in favor of steel construction in a box car is that the underframe being rigid the posts and braces only have to withstand the shocks from horizontal strains of the load, while a wooden under-frame is continually settling and the superstructure is thus compelled to assist the sills in supporting the vertical load. This state of affairs soon becomes evident, and bulging sides and ends and leaky roofs are the natural result. The natural shrinkage of a wooden underframe causes it in course of time to ride flat on the truck side bearings. This causes very great wheel flange friction. By the use of a rigid steel underframe there is quite a saving of flange friction, and the influence of this condition is shown in the drawbar pull of locomotives.

Experiments by two large railroads brought out the fact that the drawbar pull required to move one ton of freight in a properly constructed car of 100,000 lbs. capacity is 24 per cent. less than that required to move the same amount in an average wooden car of 60.000 lbs. capacity. This makes a difference of 15 cents per mile in locomotive expense. As to the maintenance charges, reports from different large railroad systems place the average cost of repairs to wooden cars from $35 to $80 per car per year, while the cost of repairs to steel cars or steel underframe cars ranges from $9 to $15 per car per year, and that on cars having been in service six or seven years.

The average life of a steel car is assumed to be 25 years and this is believed to be a conservative figure. At the end of the 15 year period of the wooden cars, the cost, earning power, depreciation, etc., of a second wooden car has been introduced in order to equalize the time represented by the longer life of the steel underframe car. The cost of the second car being taken from the sum earned by the first car at the end of 15 years and the balance being carried forward with a credit of 5 per cent. compound interest per annum.

As regards repairs to steel cars the first thought which strikes an average wooden-car man when he has to set about repairing steel cars is that he wishes he had spent some years of his apprenticeship in the boiler shop. An outlay of about $1,000 will furnish portable forges, oil burners, with air-blast attachments, pneumatic hammers, mauls, formers, drift pins, etc., necessary to keep in repair any reasonable number of steel cars. As for the education of the men for this class of work, a very few days will suffice to make experts of wooden-car men of average intelligence.

The savings brought about by the use of steel cars are, briefly, reduced number of cars required, with loss of friction and atmospheric resistance, decreased liability of wreckage and absolute security from loss by total destruction, increased tonnage pulled by the locomotive, increased mileage due to less time on repair track and consequent decreased cost of inspection.

The June Conventions.

The annual conventions of the Master Mechanics' Association and that of the Master Car Builders' Association will be held this year at Manhattan Beach, N. Y. The Associations' headquarters will be the Oriental Hotel, and it will be devoted exclusively to the convention.

At this charming resort, which is one of the environs of New York, there are three hotels within easy reach of one another by trolley lines. The Oriental is at the eastern end of the beach, which is famous for its surf bathing. About 1,400 feet west of this hotel is the Manhattan Beach Hotel, which is near one of the terminals of the Brooklyn Rapid Transit Railroad. About a quarter of a mile beyond the Manhattan Beach Hotel is the Hotel Brighton. The trolley line connecting these hotels will carry members and guests of the convention free.

The rates in any one of these three hotels are as follows: Rooms without bath, per day, for one person, single room, $3.50; double room, $4.50. Double room, two persons, $3.75 each. Extra large double room, two persons, $4.75 each. The rates for rooms with bath are as follows: For one person, $5.00 per day; double room, $6.00. Double room, two persons, $5.00 each. Extra large double rooms, $6.00 each. Rooms may now be reserved in the Oriental and Manhattan Beach Hotel by addressing the Manhattan Beach Hotel and Land Company, 192 Broadway, New York City. Rooms may be secured at Hotel Brighton by addressing Mr. George B. Parker, Grand Hotel, New York City. Exhibits will be placed on the grounds at the back of the Oriental Hotel and on its veranda. Exhibitors wishing to secure space should apply to Mr. J. Alexander Brown, secretary of the Supply Men's Association, 24 Park Place, New York City.

Giving Employees Object Lessons.

The Baldwin Locomotive Works had a large exhibit at the Louisiana Purchase Exposition, and they adopted a very liberal policy in dealing with the men they sent to St. Louis to look after it. During the summer and fall about sixty men have been sent in relays to that city and the distribution of time of each man had been so arranged that two weeks was put in caring for the exhibit and one additional week was given him by the Baldwin people in which to see the sights. An allowance for expenses pure and simple was provided for each man over and above the fact that board, lodging and transportation were given gratis.

The object of thus employing the men was to afford them an opportunity for self education and by observation and study to enlarge each his own mental horizon. These men could see at close range how other people did the same kind of work that they themselves were engaged in doing when at home. To put the whole thing in a nutshell, the men were given a first-class opportunity to get hold of other people's ideas, which is always an important factor in self education. Enlightened workmen do better work at lower cost.

We have received a copy of the *Mechanical World* Pocket Diary and Year Book, published at the Manchester office of that publication on New Bridge street. The book is of convenient pocket size and contains a collection of useful engineering notes, rules, tables and data. There are 302 pages of reading matter, and the selection of matter is good. At the end of the book there are a number of pages set apart for a diary for 1905, allotting about ¾ of an inch for a day's record. Thus a week's engagements can be jotted down on a page, and there are a few extra pages at the back for memoranda. The book sells in England for six pence.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. When a student wishes to receive a private answer, he is reminded that it is usual to send a stamped envelope for the return letter. We will be glad to answer any question relating to railway matters, but prefer that they be suitable for our question and answer department. All letters intended for Our Correspondence School ought to be addressed to Department E.

More Good Things Coming.

The truth of the saying that supply creates new demand is already coming home to us in connection with this correspondence school course. We have the best of evidence that many railway men have taken vigorously to the study of the lessons, and that others are already looking forward to studies that would supplement the course which we have engaged to publish. Already we have had several requests for an electrical course adapted to the needs of railway men who have to handle electrical appliances. It is significant that they ask for something simpler and more practical than the treatises on electricity to be found in ordinary text books.

Another set of correspondents are asking for a course of mechanical drawing that will be of practical use to men engaged in shop work. As drawing is a universal language that every shop man ought to be able to talk and read we are pleased to find that this spirit of self-help is manifesting itself among our friends in the shops.

Our intention is first to give a full course that will enable firemen and brakemen to pass the examinations that stand between them and promotion. We have heard of so many of these men being kept back lately because they failed to pass examinations, that we are losing no time in extending to them a helping hand. If a fireman or brakeman studies faithfully the simple lessons we are publishing, they will find the railway companies' examinations easy. Other trainmen who have to pass an examination as a condition to obtain employment on another road will find the mastery of this course a tower of strength.

As to our friends' ambitions to have electrical and drawing lessons, we would say, "possess your souls in patience for a few months and you will receive more than you have asked for."

Questions Continued.

65. What should be considered a bad tender or engine truck wheel?

66. What should be done if an engine truck wheel or axle breaks?

67. What should be done if a tender truck wheel or axle should break?

68. How should an engine be blocked for broken engine truck spring or equalizer? For broken tender truck spring?

69. If it is not necessary to take down the main rod on disabled side of the engine, how would one arrange to lubricate the cylinders?

70. What should be done if a driving spring, spring hanger or equalizer should break?

71. How can an engine be moved if the reverse lever or reach rod were caught at short cut-off by a broken spring or hanger?

72. How can a blowing of steam past a valve, cylinder packing or valve strip be distinguished and located?

73. If a simple engine should blow badly and be unable to start the train when on the right hand dead center, on which side would be the blow, generally?

74. If the throttle were closed and steam came out of the cylinder cocks, what might be the cause?

75. Is it possible to distinguish between a leaky throttle and a leaky dry pipe?

76. What effect have leaky steam pipes, and how should they be tested?

77. How should the test for a leaky exhaust pipe joint, or a leaky nozzle joint be made?

78. How should hot bearings be treated?

79. What should be done if a steam chest cracks?

80. What should be done if a steam chest breaks?

81. If a link lifter or arm were broken what should be done?

82. If the reverse lever or reach rod should break, what should be done?

83. What should be done if the piston, crosshead, connecting rod, or crank pin is bent or broken?

84. What should be done if a safety valve spring breaks?

85. How can an engine be brought in with a broken front end or stack?

86. What should be done when a frame is broken between the main driver and cylinder?

87. What should be done when there is a loose or lost cylinder key?

88. What should be done if a frame is broken back of main driver?

89. In case of broken side rods, what should be done?

90. What can be done if the intermediate side rods were broken on a consolidation engine, having the eccentric on the axle ahead of main wheel?

Answers Continued.

65. One with sharp flange, or flat or shelled-out spots in tread of wheel, 2½ ins. or more in length.

66. It should be entirely removed or blocked up so as to have the wheel clear of the rail, and the truck frame should be securely fastened to the engine frame with chains.

67. Pursue the same course as with the engine truck wheel and fasten the truck frame with chains to the tender frame. Move slowly and cautiously to a point where repairs can be made.

68. If pilot will not be too low, let truck frame ride on boxes; otherwise, block between top of boxes and truck frame.

Blocking for a broken tender spring will vary according to the type of truck used. Some have a coil spring over each axle box and are easily taken care of; some have semi-elliptic springs with the spring band against the tender frame and the ends of spring resting on arch bar over axle boxes, while others have elliptic or coil springs supporting the truck bolster and resting on the sand plank. With the first, block over the individual box; with the second, between truck bolster and tender frame; and with the third, between truck bolster and sand plank.

69. By removing indicator plugs, if the engine is equipped with them, oiling through them and replacing plugs.

If the engine has no plugs, shift valve just enough to show a little steam at cylinder cocks and oil with the lubricator.

70. Remove broken parts and block over box affected by break; as to blocking equalizers properly, one would have to be governed by the type of spring rigging used.

71. By disconnecting the tumbling shaft arm and blocking over link block pin with blocking that would permit sufficient power to be used to start train.

72. When the valve has been placed to cover both steam ports and no steam escapes from cylinder cock but escapes through exhaust port to stack, it indicates that valve strips are down or broken and permit steam to escape through small hole in valve to exhaust port.

If valve covers ports and steam appears at both cylinder cocks, it indicates a cut valve or seat.

If piston is at beginning of stroke and valve uncovered and steam escapes from cylinder cocks at opposite end also from which it is admitted, it indicates leaky packing rings or cut cylinder.

A valve blow continues during the entire travel of valve, while a cylinder blow is strongest when piston is at beginning of stroke and gradually diminishes until cut-off takes place as piston nears end of stroke.

73. On the left side, since that is the only power the engine has to move the other side off the dead center.

74. Leaky throttle or dry pipe.

75. Yes, a leaky throttle will show dry steam only, while with a leaky dry pipe more or less water will pass out of the cylinder cocks with the steam when the engine is standing, and when the engine is working she appears to be working water all the time.

76. They interfere with the draft on the fire and prevent the engine from making steam.

Place the lever in the center, set the air brake, open throttle and watch the joints of steam pipes top and bottom. The proper test is the hydraulic test made in the shop.

77. By placing the lever forward or back and moving the engine slowly with brakes set, and watching the joints. Cinders never accumulate around such leaks and are always driven away from them.

78. They should be cooled down gradually, so as to prevent undue strain on the metal. The cause should be ascertained, whether defective lubrication or poor workmanship, in order to guard against a recurrence of the difficulty.

79. If the crack is not too serious, temporary relief can be obtained by driving wedges between chest bolts and chest.

80. That depends on the type. With the chest commonly used to-day, take up the chest cover, insert blocking in the steam passages to chest and bolt the cover down firmly upon them.

81. Block the same as for broken link saddle pin.

82. Follow the same method as for broken link saddle pin.

83. If the piston is broken or the piston rod bent, remove both, disconnect valve stem only, and cover ports.

With a broken crosshead or bent or broken main rod, the main rod would have to come down. Then, push piston ahead or back—this depends on the type of engine—and shift valve to force steam against piston in the direction in which it was desired to hold the piston, clamp valve, and block the crosshead as an additional precaution.

With a broken crank pin the rod would not have to come down, but could rest on the yoke or guide. First ascertain in the case of a piston valve whether it is an inside or outside admission before shifting, as the movement of the former is directly opposite to that of the latter.

84. Remove the spring and block between valve and cap, allowing the other valve to do the work.

85. By boarding up and by protecting it with the canvas curtain on the cab. Placing a barrel on smoke arch in lieu of a stack will answer the purpose, but on a road with heavy traffic such expedients are not practicable.

86. The safest plan is to be towed in dead. The other alternative is to disconnect the disabled side and bring the engine in light, because an attempt to bring in part of the train might damage the previously uninjured side.

87. If the key is loose and can be shimmed up, it is safe to go on. If key is lost and nothing available in its place, disconnect that side to prevent further damage.

88. Take down side rods on both sides back of main driver and proceed.

89. Take down corresponding rod on opposite side also, and, if it is a consolidation, mogul or 10-wheel engine and the intermediate rod is broken, all side rods would have to come down.

PRIMITIVE RAILWAY CAR.

90. There is nothing to be done but be towed in, unless only one side is broken, when it would be possible to bring the engine in under her own steam on one side, with the disabled side having its valve disconnected and ports covered, but this is not advisable, inasmuch as the engine might slip and break the other intermediate rod and do incalculable damage. All side rods ahead of the intermediate on both sides would have to come down.

GENERAL Questions Answered

EFFECT OF ALTERING THE STROKE.

(1) P. W., Dennison, O., writes:

1. If we take an engine with 20x24 in. cylinders and 50 in. driving wheel centers, and apply new cylinders 24x28 in. and new driving wheels of the same size, what would we have gained theoretically and what difference could we expect in the hauling capacity of the engine? A.—We answered a somewhat similar question on page 215 of our May, 1904, issue. If you will substitute the new values you propose in the formula for calculating the tractive effort you will see that, others things being equal, you gain hauling power by the increase in cylinder size, as both cylinder diameter and stroke are factors used to multiply with in the formula. This is true only up to a certain point, beyond which the engine would be over cylindered. See article on the "Frictional Limit," on page 20, January, 1903, issue.

2. Will increase of stroke without making any change in weight or boiler pressure enable an engine to pull more? A.—Yes, it will; as you will see by reference to the tractive effort formula, stroke is one of the factors used to multiply with, and other things being equal, the larger the number you multiply with the larger will be the result. This is true only within the limits set by the friction between wheel and rail.

3. Would the engine with increased cylinders be more liable to slip than previously, and if not, why not? A.—The engine would be more liable to slip with size of cylinders increased. The nearer the tractive effort approaches the frictional limit the greater the likelihood of slipping. The article above referred to explains this point more fully than we have space for here.

POSITION OF CYLINDER CENTER LINE.

(2) G. M., Wellington, New Zealand, writes:

1. Would you tell me why it is now the usual British and American practice to place locomotive cylinders an inch or two above the center line of the wheels? A.—There is no particular hard and fast rule about this. The cylinders are sometimes raised an inch or so in order to make more room for truck wheels.

POINT OF SUSPENSION OF LINK.

2. Why is it desirable to locate the point of suspension on the link 3/16 of an inch behind the radial center line of the link? A.—The effect of the angularity of the connecting rod is that it tends to delay the cut-off during the backward stroke of the piston and to accelerate it during the forward stroke. Hanging the link back of the center corrects this irregularity of cut-off.

FREEZING TEMPERATURE OF SALTY WATER.

(3) A. G. D., Chicago, asks:

1. What is the temperature at which salty water in Baker heater circulating pipes freeze at? A.—Water freezes at 32° F., but a saturated solution of common salt must be cooled down to 4° F. freezing.

DOUBLE SEAT OF THROTTLE VALVE.

2. Why is the throttle valve of a locomotive a double seated valve? I no-

tice that the Gold Car Heating Company's pressure regulating valve is also a double-seated valve. A.—The throttle valve of a locomotive is usually made with double seat, the lower or inside one being of slightly smaller diameter than the top. This is done so that the valve being almost balanced may be opened and closed easily, and when shut the greater pressure on the top will tend to keep it securely closed unless purposely opened.

AMOUNT OF LEAD REQUIRED.

(4) W. M. S., Cienoga, asks:

1. What is the proper "lead" to give a 10-wheel passenger engine, with the following dimensions: Cylinders, 18x24 ins.; boiler pressure, 180 lbs.; diameter of drivers, 5 ft. 6 ins.; weight on drivers, 92,288 lbs.; weight on engine truck, 30,128 lbs.; total weight of engine in working order, 122,416 lbs. This class of engine is to handle a fast passenger local over a fairly hilly division? A.—One-tenth of an inch lead would be good practice for this engine. If the load she pulled was light, it might be slightly increased with advantage.

2. What is the proper "lead" to give a consolidation engine, with the following dimensions: Cylinders, 20x24 ins.; boiler pressure, 180 lbs.; diameter of drivers, 4 ft. 2 ins.; weight on drivers, 115,472 lbs.; weight on engine truck, 13,776 lbs.; total weight of engine in working order, 129,248 lbs.? This class of engine is to handle very heavy freight traffic over a fairly hilly division. A.—This engine might be given 1/16 in. lead. One ought also to know the lap and travel of the valves and more particulars as to the kind of work to be done in order to get best results.

PISTON AND PISTON VALVE LEAKING.

(5) Inquirer asks:

Can't you distinguish by sound the difference between the leaking of a piston and the leaking of a piston valve when running? A.—It is extremely doubtful that you would be able to tell correctly in that way. You might possibly distinguish between them by observing the cylinder cocks, when you were running quite slowly.

PRESSURE ON JOURNALS.

(6) Learner asks:

How do you measure the pressure on car journals? It is spoken of as so much per square inch; how could I get the total weight on the journal? A.—The weight on a car journal is computed for an area made up of the diameter of the journal and its length. Take the M. C. B. standard, 3¾x7 in. journal, for example. The area upon which the weight is supposed to rest in this case is 26¼ sq. ins. If the journal load was 200 lbs. per square inch you would have 5,250 lbs. in all on that journal.

RAILROAD STATION SIZE AND RIGHT TO GIVE NEW NAME.

(7) R. B., New York, asks:

1. Which is the largest railroad station in the world; that is, as to tracks? A.—The Union Station, at St. Louis, and the St. Pancras Station in London, are probably the largest in the world.

2. Has the New York Central a right to call its leased lines, namely, the L. S. & M. S., the M. C. R. R., the C., C., C. & St. L., etc., the "New York Central Lines?" A.—Yes, it has that right; a lease transfers the right of possession, it is really a grant of interest. If you take a lease of a house and pay rent for it, you have every right to speak of it as "my house." A railroad company is a group of men; what is commonly called the railroad is simply the property of the company and that may be disposed of or named in any way. For instance, the C., C., C. & St. L. is legally incorporated as the Cleveland, Cincinnati, Chicago & St. Louis Railway Company, yet it labels all its property "Big Four." If that company leased its property, the lessees could call the property by another name if they so desired.

POUNDS OF STEAM PER HORSE POWER AND FOAMING WATER.

(8) O. J. B., Hopkins, Minn., asks:

1. What is meant by an engine using so and so many pounds of steam per horse power? See RAILWAY AND LOCOMOTIVE ENGINEERING for February, 1901, page 89, center column. A.—The expression you refer to, speaks of the Dow turbine as using 45 lbs. of steam per horse power. This expression means that the steam drawn from the boiler to develop one horse power in this engine was the evaporation of 45 lbs. of water by weight. The expression does not refer to pressure.

2. Some of the large engines on the M & St. L. have been equipped with pipes running from the steam chest up over the outside of the smoke box and up behind the stack, through which part of the exhaust passes; what is the function of those pipes? A.—They are probably attachments belonging to the Sarver auxiliary exhaust valve.

3. Why is it that when the throttle is closed the water will sometimes drop in the glass? A.—This effect is generally noticed when the water is foaming. Water which contains matter which causes it, when agitated, to form bubbles or froth will generally do this. The higher water level seen in the glass when the throttle is open is due to the uprush of frothy water, through which steam bubbles do not readily pass. Closing the throttle stops the flow of steam toward that valve and lets the frothy water drop.

A RUSSIAN FREIGHT TRAIN. ENGINE BUILT IN GERMANY. CARS CONVERTIBLE SO AS TO CARRY SOLDIERS IN WAR TIMES.

WHY IS POUND GREATEST WHEN CRANK PIN PASSES FORWARD CENTER?

(9) B. S. P., Nashville, Tenn., asks:

Why is it that an engine pounds harder when passing the forward center than when passing the back center? A.—This question was discussed by Mr. J. M. Foster, of the Collinwood, Ohio, shops, some time ago. He says: "When the crank pin passes the forward center the movement of the engine and frame is forward and the thrust of piston on main rod is backward, the wheel is slid backward on the rail and the loose box comes up against the advancing pedestal with a slam or the worn journal meets the back side of the box in the same manner. On the other hand, when the crank passes the back center, the pull on the main rod finds the engine and frame moving in the same direction, and the box or journal is pulled up to its space with the rolling of the wheel. The result is a much less perceptible pound. It's about like the difference between kicking a man coming toward you and one running away."

NUMBER OF OIL DROPS IN A PINT.

(10) G. K. W., Toledo, Ohio, asks:

How many drops are there to a pint of valve oil? A.—The number of drops in a pint of valve oil discharged through a lubricator varies according to conditions. Temperature, feed, choke openings and the grade of oil used must be considered. With a new lubricator working under favorable conditions vacuum valve oil will give about 5,500 drops, while perfection valve oil will give about 7,400. In some copies of a former issue, 600 drops were given as the correct number, but this was a typographical error and, unfortunately, a number of copies of the paper escaped us before the error was caught up and corrected.

HEAVIEST LOCOMOTIVE.

(11) A. D. P., Winnipeg, Man., asks:

What is the heaviest locomotive known in this country? A.—The Mallet four-cylinder articulated compound engine is the heaviest locomotive. It was built by the American Locomotive Company for the Baltimore & Ohio, and was exhibited at the St. Louis Exposition. The engine weighs 334,500 lbs. and the tender about 143,000 lbs., making a total of 477,500 lbs. The engine has cylinders 20 and 32x32 ins. and 56 in. driving wheels. It was fully described and illustrated on page 283 of the June, 1904, issue of RAILWAY AND LOCOMOTIVE ENGINEERING.

AIR BRAKE CORRESPONDENCE

PYLE NAT. ELECTRIC HEADLIGHT.

(1) Would you advise the placing of dynamo exhaust pipe so exhaust will pass out of the smokestack or so it will pass over engine cab or on outside of smokestack? A.—Outside stack; too much back pressure on turbine in stack.

(2) M. A. H., Tyler, Tex., asks:

Assuming that it is a broken reversing rod in the New York duplex pump that has caused the pump to stop, how can it be ascertained which side the defective rod is on? A.—Remove the air cylinder oil cups from both cylinders, and turn on the steam. If the pump stops with the low pressure piston at the top of its stroke, and the high pressure at the bottom of its stroke, then the trouble is in the low pressure side. If the pump stops, and both pistons are at the top of their respective cylinders, then the trouble is in the high pressure side.

(3) M. A. H., Tyler, Tex., asks:

If reversing rod in the high pressure piston is broken off at the shoulder, steam has been shut off and both pistons settled to their lowest positions, how can the broken reversing rod be removed and a new one inserted? A.—Turn on the steam, and both pistons will move to the top of their cylinders and stop. Remove oil cup on the air cylinder and the steam dust cap nut on the steam cylinder of the high pressure side. Then insert a rod through the oil opening on the high pressure side and force high pressure piston down until defective rod can be removed and new inserted. Piston will be about the center of the cylinder when reversing rod is removed and replaced.

(4) M. E. H., New York City, asks:

Is the first 5 lbs. of air, which goes to the brake cylinder, effective pressure; that is, is it as effective as the second or third 5 lbs. which goes to the cylinder? A.—It depends entirely on the way in which the word "effective" is used. If it is used merely with respect to the forcing of the brake shoes against the wheels, then this first 5 lbs. is not as effective as the second or third; for the first 5 lbs. merely fills the cylinder, and it is preparatory work before the brake shoes begin to rub the wheels. On the other hand, the first 5 lbs. going to the brake cylinder, while forcing the piston out and preparing for the actual braking power, performs a certain work of pushin gout the piston and filling up the vacuum due to the piston going out, and it may, therefore, be said that in this case the first 5 lbs. is just as effective as the second or third 5 lbs., because it does actual work, even though this work is preparatory work and not final work.

(5) B. R. E., Collinwood, O., writes:

Why is that when the slack adjuster is put on a car, that you have to take up your slack by hand on the dead levers, the same as you had to do before. If you do not do this, the levers will be brought up against the hangers before a set of brake shoes is worn out, and force of the brake will go to the hangers instead of to the shoes, and the car will not hold. A.—In designing foundation brake gear for a car in the past it has been the custom to take up the slack in the brake rigging, due to the wear of the brake shoes, at the dead lever on each truck. This method pulls the slack away from the cylinder and disposes of it with the dead lever. When the slack adjuster is installed on a car, it is placed on the brake cylinder, and the slack is taken up on the cylinder lever, thus pulling the slack toward the cylinder and away from the trucks. In locating the carriers for hand adjustment, and slack is taken up by the dead levers, care is taken that the levers shall not strike the carrier supports; but when the slack adjuster is installed and the slack pulled up in the opposite direction, away from the trucks toward the cylinder, a corresponding and necessary change must be made so that the levers will not strike the carrier supports.

(6) L. R. E., Burlington, Vt., writes: writes:

What is the cause of the brake on a car acting this way? I run a train of seven cars and when making a service application of about 6 lbs., after the train line exhaust has closed, in about three seconds there is a perceptible jerk from the rear car as though the emergency had been applied; but the train line pressure has not been lowered any on the gauge. It acts to me as if the pressure did not graduate into the cylinder with the other brakes, but that the full pressure was obtained in cylinder from the 6 lb. reduction, when the piston moved out with a rapid movement causing the brake to set quick on this car. A.—Your trouble may be due to the piston travel on this rear car being taken up closer than on the other cars, thus causing it to brake heavier than the others. Again, it may be that the car is actually going into quick action, and the train line reduction is not shown on the gauge, because the packing ring in the equalizing piston of the brake valve is a very snug fit, preventing pressure above the piston leaking by to the under side. To decide this question, apply the brake with 6 or 8 lbs. reduction when standing still, and note the action of the brake under this car in question, observing whether its application is of the emergency kind. A gauge screwed into the brake cylinder would be a great assistance in locating this trouble.

(7) R. L. C., San Francisco, Cal.,

Which will stop a train quicker, a brake which gives an equalization of reservoir and brake cylinder pressure through large ports, or one giving a flash of train pipe pressure through a large port and a slower equalization of auxiliary reservoir pressure through smaller ports? A.—In a recent series of carefully conducted tests, made to decide this and other questions in doubt, the latter brake made shorter stops.

By the completion at Queenstown of the laying of a submerged main at a depth of 86 feet across the channel in Cork harbor, which separates Queenstown from the government island of Haulbowline, a record in hydraulic engineering has been established.

Air Brake Department.

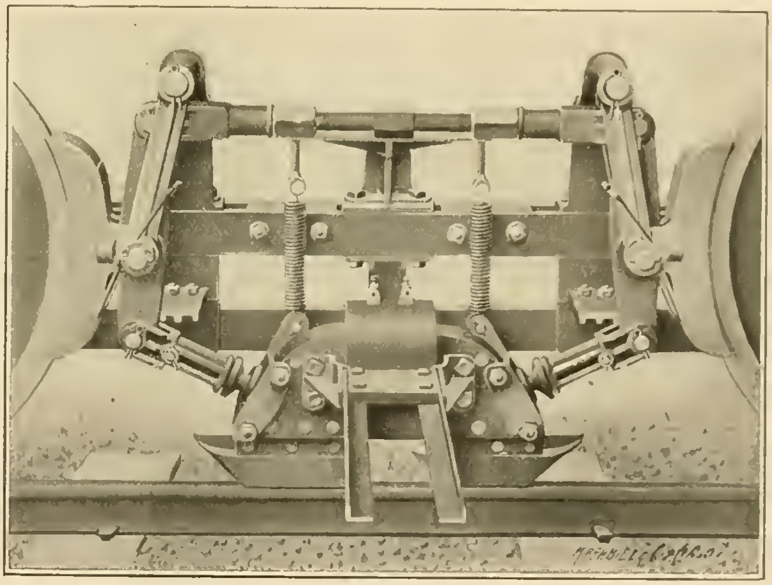
CONDUCTED BY F. M. NELLIS.

An Electric Brake.

That electricity is not only crowding out the steam locomotive, but that it is rapidly encroaching on other railroad work is quite evident from recent inventions and developments. The brake field is the last one of the railroad fields to be invaded, and, while not supplanting the air brake, it is not impossible that electricity may, in the near future, have something incidental to do with brake operation on railroads.

Up to the present time all electric attachments to air brakes, upon trial, have been found deficient and faulty, but that a successful development of this branch of the work is a matter of the near future, is shown by the illustration herewith. The illustration shown is a view from between the rails, showing the operation of a brake operated and controlled by electric current. The track brake shoes, suspended above the rails, are connected by a magnetic coil which is energized by electric current. When the current is sent to this coil, it magnetizes the brake shoes, which, in turn, are drawn to the rails and caused to slide along with considerable friction. Not only does this friction retard the motion of the car, but it forces back against a lever, which, in turn, forces the brake shoe against the wheel. There is a thrust rod connected to the top end of the lever, which transmits the force further along to the forward lever and brake shoe as shown in the cut. Thus braking is done by the sliding shoe on the rail and also by the brake shoes on the wheels.

The degree of braking force is determined and regulated by the amount of electric current sent to the coil connecting the track shoes. This current is generated by the regular motor on the car, which, when the propelling current is cut off at the controller by the motorman, still revolving, becomes a generator and sends current to the magnetic coil and the brake shoes. The higher the number of revolutions the motor is making, the higher current it is sending out; therefore, the higher the speed of the car the higher is the braking force. As the speed of the car reduces, the revolutions of the armature, of course, reduce proportionately, thus automatically reducing the braking power of the car as the speed of the car is reduced. If the rail conditions are bad, and the wheels begin to skid on the rails, the armature of the motor, being mounted on the car axle, also stops and ceases to send out current to the magnetic coil, and the wheels, being relieved of pressure, will immediately start rolling again; for the instant that the wheels begin to slide braking power is annulled and the wheels must begin to roll. Thus we have a perfect automatic reducing brake which brakes proportionately with the speed of the car, giving highest braking power at higher speeds, and gradually and accurately reducing the braking power as the speed of the car reduces. From a brake standpoint, this is an ideal brake.



AN ELECTRIC BRAKE.

CORRESPONDENCE.

Limited Pump Speeds.

Mr. Langan, in November issue, recommends that the pump be run no faster than 140 single strokes per minute to keep his 75 and 100 car freight trains pumped up. If the pump will not supply the train, the train is held in the yard by the inspectiors and repair men until all leaks are taken up, and the pump can supply the train.

It may be possible on Mr. Langan's road to do this, but very few roads would stand for a delay of one-half to a full hour on a fast freight train taking up leaks. It is about all we can do to spare the time to switch the cars so the air can be all coupled up, and a single test made, let alone taking up any leaks. This may be possible on Mr. Langan's road, but I doubt that it is on any other road. J. J. BURNS.

Cincinnati, Ohio.

Speed of Air Pumps.

Mr. Langan's correspondence in November issue, regarding a stated speed of air pumps in freight service, has hit the nail on the head squarely.

Instead of Mr. Langan attempting to pump the whole train and the whole outside atmosphere by running the pump at an excessive speed, which will break air valves, ruin seats, pull off the air piston from the rod, and break the reversing plate from the piston, he prefers to take up leaks in the train pipe and its connections in such a way that he can supply the train pipe with pressure, by running the pump at a reasonable speed. Mr. Langan further states that 140 single strokes per minute have been arrived at after considerable actual experience in freight train service. Mr. Langan seems to have this matter well in hand, and, therefore, the air brake people in general may accept what he says. His actual experience and practice can be safely adopted. I should like to hear from other air brake men who have tried to reduce their pump failures by this or other means and how they have succeeded. A. L. JENNINGS.

Buffalo, N. Y.

The Forsyth Automatic Train Pipe Coupler.

The Forsyth Automatic Coupler is manufactured and controlled by the New York Air Brake Company. It is designed for use on both passenger and freight trains, is simple in construction, and therefore does not require much description to make its operation clear, since the drawings furnish about all the description necessary.

By means of the improved method of piping and the flexible joints which this automatic coupler has, the coupler head can accommodate itself to all the varying heights of cars and the different degrees of curvature upon which they may be run. The gaskets in the coupling heads are held firmly face to face against each other, when the two heads are brought together, by the pressure of the conical springs behind them.

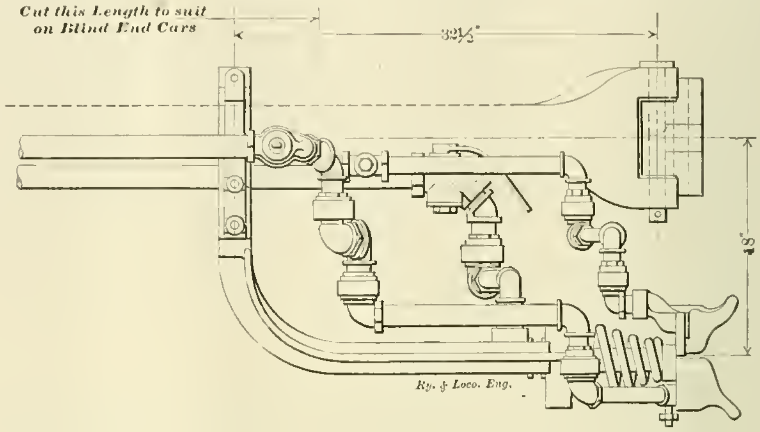
The brace, to which the coupler is attached, extends backward and upward to the drawbar (32½ ins., as shown in Fig. 2), where it is securely attached. This brace holds the coupler head in the proper position, while the conical springs and the flexibility in the pipes and couplings allow for the easy movement of the coupler heads, either vertically or horizontally, or both, as may be required. When in the act of coupling, the coupler heads are guided and brought together in proper alignment by wings, or guides, cast upon their faces.

When separating the cars the automatic train pipe coupler simply separates from its mate. There is no tearing, or pulling, or upsetting of gaskets which would produce a damaging effect upon the pipe connections or on the gaskets in the face of the coupler head; and since no rubber hose whatever are used, the damage and expense which their use entails are entirely eliminated.

The gaskets used in the coupler head, since the pressure is brought face to face in coupling, and in the separation of the coupling no pressure or friction is brought upon them, last much longer than in the present style of hose coupling, and they also give less trouble from leakage during their term of service.

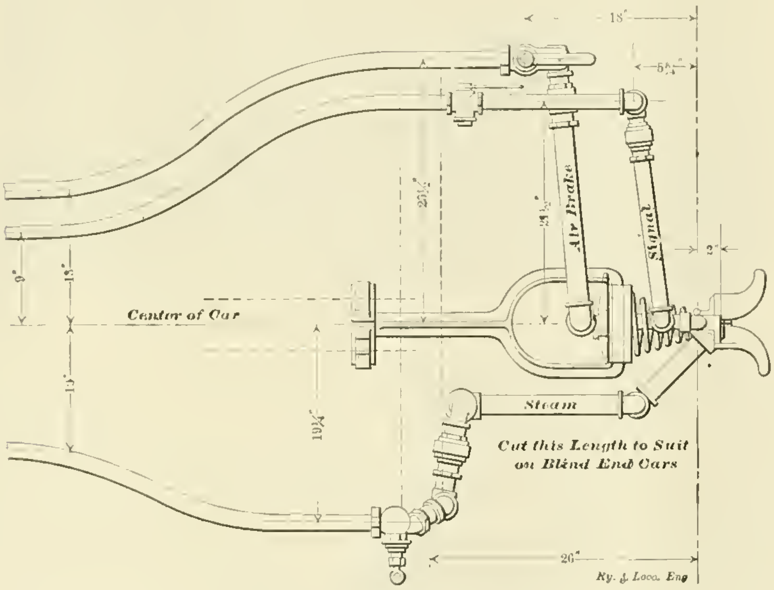
Fig. 1 is a plan view, showing the various train pipe connections, air signal pipe, brake pipe, and steam heat pipe and the location of the train pipes with respect to the center line of the car.

In the application of the coupler to freight cars, but one train pipe connection to the coupler head is necessary, thus making its application practically as simple as that of the present air hose.



SIDE VIEW, FORSYTH AUTOMATIC TRAIN PIPE COUPLER.

Fig. 2 is a side elevation of the coupler in which the method of attaching the brace to the drawbar, and the distance back from the drawbar head that the brace is usually attached is shown. It also gives the distance between the center line of the automatic train pipe coupler head and the center line of the drawbar.



TOP VIEW, FORSYTH AUTOMATIC TRAIN PIPE COUPLER.

Fig. 3 is a front elevation and shows the distances of the center line of the various train pipes above the center line of the automatic coupling head.

In the making up of trains in the yards the time saved, in not being obliged to make the pipe couplings by hand, is considerable, and this saving, together with the immunity from accident and delay, caused by burst and leaky hose, is a strong recommendation for the automatic train pipe coupler.

Several large roads in the country now have trains running in daily service that are equipped with this coupler and they have experienced entirely satisfactory results from it in practical operation.

J. P. KELLY.

Watertown, N. Y.

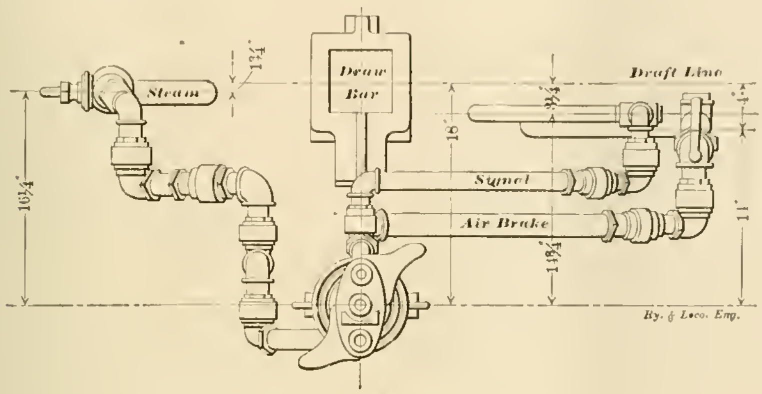
Valve Coupling and Dust Guard.

The valve coupling and dust guard herewith illustrated is a device interchangeable with the coupler now in use. It contains a valve which is controlled in its position by air and spring pressure, and which will, in the event of a train parting or breaking in two, automatically apply the brakes to the rear section, while the application of the brakes on the forward or engine section, will still remain under the control of the engineer, thus preventing the two portions of the train from colliding. This coupling also serves as a dust guard in the train line by preventing any dust or dirt from entering same.

The coupler consists of a brass valve (A) inclosing a spring (D) in the cylindrical projection in the rear of same. The cylindrical projection in the rear of the valve works back and forth in a brass lined hollow nut (B) which is fitted to the coupling head. This hollow nut has an opening in the rear (C) to prevent any vacuum or pressure from interfering with the free action of the valve. The valve seats forward by spring tension into coupler opening, and seats back by air pressure against rubber packing ring (F). The valve is provided with a port or by-pass (E) extending transversely through the face and out through the center of the same (E-2).

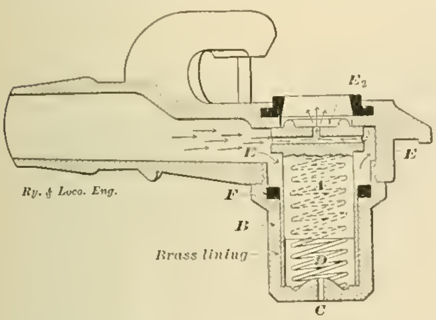
The construction as above described constitutes a piston working inside of a valve pocket. With no air in the train line, the valve, even though the coupler is connected with an adjacent coupler, will be seated against its seat in the coupler head.

Upon admission of air to the train pipe, air will rush through the post (E) forming a counter pressure on the face of valve, overcoming the resistance of the



END VIEW, FORSYTH AUTOMATIC TRAIN PIPE COUPLER.

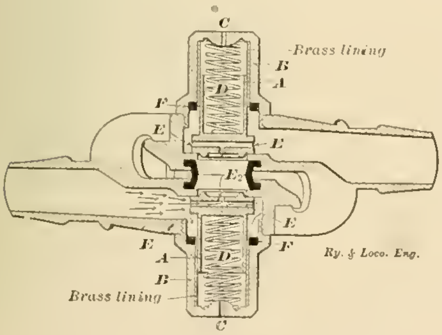
spring, and force said valve back against its seat on rubber packing ring (F), where it will remain as long as the train



HOSE COUPLING DUST GUARD.

pipe pressure is maintained, allowing a free passage of air from the engine back through the entire train, and will not interfere with the brake functions, for it cannot close as long as the pressure is in excess of seven pounds, the tension of the spring.

Should a train part, or break in two from a busted hose or any other cause, the valves at the point of separation close



VALVES COUPLED. NO AIR PRESSURE.

immediately where the coupling heads are pulled apart, thereby preventing the escape of air, except such as will leak through the port (E) in the valves of the parted couplers. ALBERT OLESON.

Toledo, Ohio.

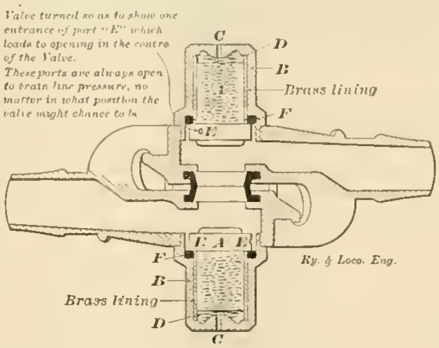
Indicator for Left-Hand Air Pump.

I am sending a rough sketch of an indicator for left-hand air pumps, made from an oil cup.

A suitable piston, P, is made to fit the oil cup, with rod extending through the thread end. On the end of piston rod, a white disk about 2 ins. in diameter is fastened. The cap, C, is tapped for ¼ in. pipe.

The indicator may be fastened to the brake valve or any place in plain sight of the engineer, by means of a brace or hanger, B.

The cap end is attached to a port drilled in the plug or in bottom head of the pump by pipe, E. Each movement of pump piston may be noted by movement of disk, D, thereby notifying the



VALVES COUPLED. UNDER AIR PRESSURE.

engineer of the working of his pump. S is a weak spring to insure return of piston, P, to lower position.

Thinking this "kink" might benefit others, I thought I would send it to you. JNO. W. GRAYBILL.

Bridgeport, Ohio.

Graphite for Triple Valves.

Now that winter has set in good and hard, it makes you think about last winter's troubles and what you may expect to happen again this winter.

Last winter we had a lot of trouble with triple valves on high speed brakes going into undesired quick action. A good deal of this was due to the oil in the triple valve getting so chilled that the slide valve would not move easy, and when it did move, it went with a jerk and gave undesired emergency.

We have had no trouble this winter, so far, and there has been some zero weather, too. I have been mixing a little graphite in the triple valve oil, and it gives fine results. There is no trouble from it stopping up the ports.

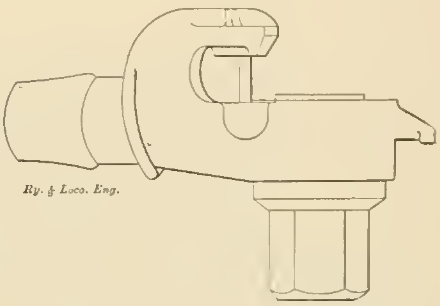
W. E. HARRIS.

Washington, D. C.

Frozen Train Pipes.

The recent cold snap has been a good test on the value of the scheme for trapping the moisture in the main reservoir where it can be drained off, instead of permitting it to pass back into the train pipe and triple valve to freeze and give trouble.

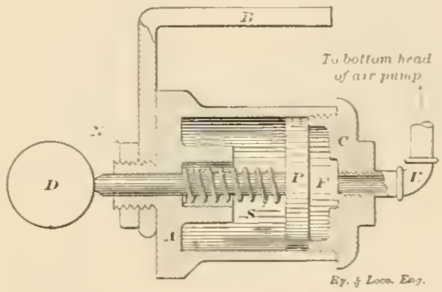
From inquiries made around among air brake men in this section since the real cold weather set in, I am unable to



OUTSIDE VIEW VALVE COUPLING.

find a single case of a train pipe or triple valve freezing where the engine was supplied with a discharge pipe of sufficient length to cool the air at its delivery to the main reservoir so the moisture would be condensed and deposited. The length of discharge pipe averages about twenty-five feet, according to air brake men I have discussed the subject with.

One man reported several train pipe freeze-ups, but in every case the engine was equipped with a short pump discharge pipe, or single small main reservoir.



INDICATOR FOR LEFT HAND AIR PUMP

One pump discharge pipe forty feet in length was frozen up. AMOS JUDD.

Boston, Mass.

A Northern Pacific Mikado.

The Brooks shops of the American Locomotive Company have recently turned out some heavy engines of the Mikado or 2-8-2 type for the Northern Pacific Railroad. The engines are remarkable in appearance, the low diamond smokestack, and the small distance between the top of the boiler and cab roof strike the eye at once.

The engines are simple and have cylinders 24x30 ins. The calculated tractive power is 46,630 lbs. The pistons drive on the third pair of 63-in. wheels and all the wheels are flanged. The drivers are evenly spaced, being exactly 66 ins. apart and this is probably the minimum spacing possible. The pony truck in front is equalized with the first two pair of drivers and the carrying wheels at the back are equalized with the two back pair.

The valve motion is of the piston type and is driven by direct valve motion, an almost straight transmission bar passes over the axle of the second driver. The engine is equipped with two 9½-in. air pumps and the main reservoir is made in two parts, one being under each running board, the total cubic capacity being 60,000 cubic ins. The stack is of the diamond pattern with the whole of the stalk or draft pipe extending down into the smoke box about 22½ ins. and the petticoat pipe is 41⅜ ins. long and extends up to the lower level of the inside draft pipe. The exhaust nozzles are low.

The boiler is an extended wagon-top type and is 75¾ ins. in diameter at the smoke-box end. The heating surface is 4,007 sq. ft. and it is made up of 3,789 sq. ft. in the tubes, 200 in the firebox, 9 in the tubes which support the brick arch. The grate area is 43.5 sq. ft. The tubes in this boiler are iron, 2 ins. in diameter, and there are 374 of them.

The trailing truck is radial and has a self-centering device. The tender frame is made of structural steel and the tank is made with a water bottom and will hold 8,000 U. S. gallons. The coal capacity is 12 tons. Some of the principal dimensions are as follows:

GENERAL DIMENSIONS.

Wheel Base—Driving, 16 ft. 6 in.; total, 34 ft. 9 ins.; total, engine and tender, 63 ft. 1 in.

Weight—In working order, 259,000 lbs.; on drivers, 196,000 lbs.; engine and tender, 405,500 lbs.

Axles—Driving journals, main, 10 ins. x 12 ins.; others, 9½ ins. x 12 ins.; engine truck journals, diameter, 6¼ ins.; length, 12 ins.; trailing, 8½ ins.; length, 14 ins.; tender, 5½ ins.; length, 10 ins.

Boiler—Working pressure, 200 lbs.; fuel, bituminous coal.

Fire Box—Length, 97 ins.; width, 66 ins.; thickness of crown, ½ in.; tube, ⅝ in.; sides, ⅜ in.; back, ⅜ in.; water space, front, 4½ ins.; sides, 4 ins.; back, 4 ins.

Crown Staying—1 in. radial.

Tubes—Length, 19 ft. 6 ins.; gauge, No. 11.

Valves—Piston, travel, 5⅝ ins.; steam lap, 1 in.; ex. lap, 0.

Wheels—Engine truck, diam. 33¼ ins.; kind, Boise plate; trailing, 45 in. spoke; tender, 32 ins.; cast iron.

HEAVY 2-8-2 ENGINE FOR THE NORTHERN PACIFIC.

D. Van Alstyne, Mechanical Superintendent. American Locomotive Company, Builders.

Wrong Time to Do It.

The general manager of the Gates & Sprue Foundry and Smelting Company was wandering over his extensive plant with a visitor one sunny afternoon in the early fall when golfers delight to golf.

The G. M. was sad, not to say dejected, as he gazed on the huge furnaces standing idle, towering there in their solitary grandeur, smokeless, fireless—efete. Bluish icles of cold iron hung from their troughs, browned by the blown sand of the foundry floor. Slag knobbed and withered and gray lay in patches behind and around them. Everything spoke of effort stopped and work abandoned. Wind blew the dust from the skylights inboard as it had never done before.

"Oh," sighed the general manager, "look at those magnificent furnaces, the latest design, the best material, the finest workmanship, a positive blower system, everything tiptop and all ruined. Oh, it is too bad!" "What happened to knock you out?" inquired the sympathetic friend.

"Happened!" roared the general manager. "When everything was in good, going, A1 shape, the men struck."

"Well, so much the worse for them, I should think," said he of the sympathetic heart.

"No, you blamed fool," replied the irate G. M.; "don't you see the mistake of the whole thing, and why so much loss and damage has been done, and why our furnace linings have been spoiled—the men struck while the iron was hot!"

Winter Resorts.

In "The Four-Track Series" of books and pamphlets of travel, issued by the Passenger Department of the New York Central, is No. 5, "America's Winter Resorts." It is especially valuable, as it contains a map of the entire United States, a portion of Mexico, and Central America, as far as the Panama Canal. It also gives sections of the Panama and Nicaraguan Canals.

There is also a map of the Hawaiian Islands, and an outline map of North and South America including the West Indies. There is also a map of the Pacific Ocean, including various American routes from the United States to Australia, New Zealand, the East Indian Islands, the Philippines, Japan and China, with a large amount of information in regard to winter resorts, with the rates one way and the round trip, and a brief description of some of the principal points. A copy of this folder will be sent free, post paid, to any address on receipt of a two-cent stamp, by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

Economical and Sanitary Car Cleaning.

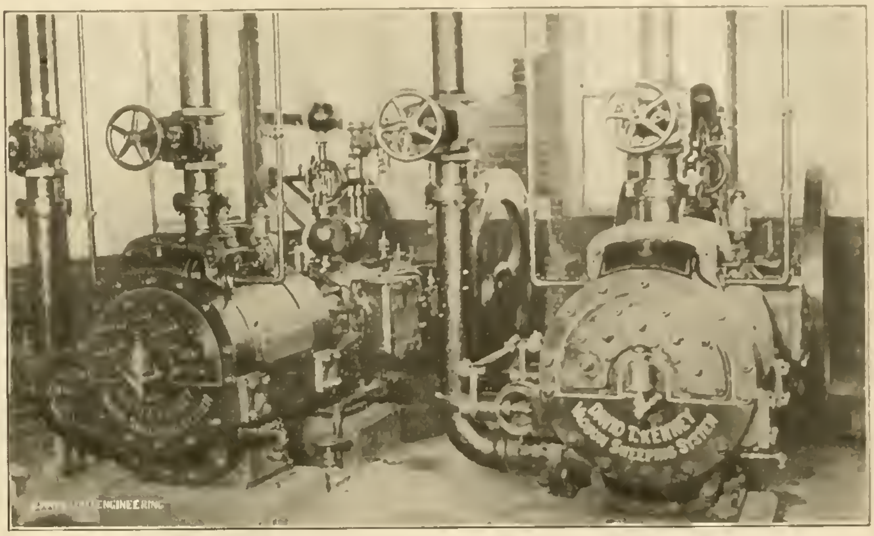
If you have ever looked at an energetic man beating a carpet, you have probably observed that it took a great deal of hard work and time to actually dislodge the dust and dirt, and that the carpet was made to suffer very severely in the process. That is an object lesson on cleaning where wear and tear are at the maximum. If you have watched the gentler process carried on by a maid dusting articles on mantelpiece and tables, or sweeping a room, you have no doubt come to the conclusion that what she does is not so much a dust-removing operation as it is a dust-displacing and dust-shifting operation in which a great deal of time is spent for very imperfect results, though the wear and tear is light. The Kenney Vacuum Sweeping System as we saw it applied to the cleaning of cars in the yard of the Central Railroad of New Jersey was a revelation in the art of getting rid of dust, which makes the hard working carpet beater and the tidy housemaid look like very small change indeed.

The plan which has been admirably worked out by Mr. David T. Kenney, of 72 Trinity place, New York, is briefly

CLEANING CAR SEATS—KENNEY VACUUM SYSTEM.

that a system of pipes is run through the yard with ground jointed inlet roundway cocks placed at convenient points, and a vacuum pump with mechanically operated valves, and stationed in the power house creates a high vacuum, and draws air through the system of piping which covers a distance of 3,600 ft. There are in all about 3 miles of piping varying from 5 to 2 ins. in diameter. There are many interesting details in the operation of this system, but that much is the idea in a nutshell.

From the various couplings, hose pipes are led to the interior of cars, and any one of these hose terminates in a metal pipe with a flat triangular end, along the base of which is an opening that is simply a slot. When the "air drawing machine," as the inventor calls the pump, is in operation, air is drawn



AIR DRAWING MACHINES—VACUUM SWEEPING SYSTEM.

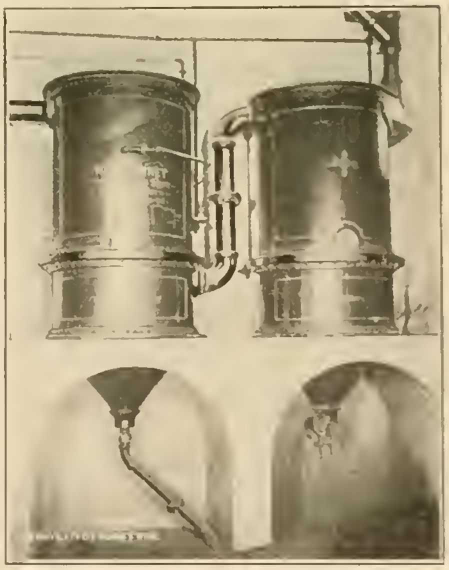
into the pipe and enters through the long thin slot opening at such velocity that it carries in all the dust in the immediate neighborhood of the slot.

This pipe with the slot opening is run quickly and evenly over the plush seat covering of an ordinary car and forthwith the dust disappears. It does not get blown or driven off a seat back onto the seat itself or onto the ground, there to cause trouble again; it is taken entirely out of the car once and forever with one operation with a minimum of time and a complete absence of wear and tear, and those things spell Economy in large letters in car cleaning and maintenance.

As the beauty and simplicity of the whole thing begins to enter the ob-observer's mind he will be shown the couplings which are made tight with ground joints and do not require washers or gaskets. The easy curve of all the pipe bends is assured. Specially made recessed pipe fittings are used which preserve the unbroken diameter of the pipe-line all through and guarantee a smooth bore from end to end of the system. Iron pipes specially selected for their smooth interiors only are used, and there is nothing inside the pipes or fittings to arrest the flow of dust-laden air when once it has been drawn into the system.

A very important detail here comes in, and that is, that just as this dust-laden air is approaching the air-drawing machine it enters and passes to pass through two dust separators, and by the time the air reaches the valves and chambers of the pump it is entirely free from dust or grit and can also be freed from germs if need be. The two cylindrical separators are simple in the extreme The first is the one in which mechanical separating takes place, and in it 90 per cent. of the dust is taken from the air. The second cylinder draws the air through water and completes the purification. If corrosive sublimate is used in this water the air comes off not only free from dust and dirt, but thoroughly rid of all organic matter. Both these separators are cleaned daily, the one containing water is usually piped direct to the sewer.

In the Jersey Central yards at Jersey City, of which road Mr. W. G. Besler is general manager and Mr. W Mackintosh is superintendent of mo-



DUST SEPARATORS—VACUUM SYSTEM.

tive power, this system has practically doubled the number of cars cleaned. Carpets are swept, seats are gone over, curtains have the dust drawn from them, and mouldings and woodwork have the dust sucked off quietly and quickly and in a way which leaves nothing further to be desired. The entire Pullman equipment which runs into this terminal is daily cleaned by this system. Private cars or diners can be cleaned without being taken out of the train shed when necessary. The staff of cleaners at any station so equipped can handle more cars than the same number of men elsewhere, because the Kenney vacuum system does not cause dust to fly through the car, to settle again somewhere else and be again wiped off. The Kenney system does not disturb any dust until it is actually sucked into the slot-mouthed cleaning pipe and headed for the separators and the sewer.

The absence of wear and tear on the equipment of the C. R. R. of N. J. will prolong the life of all kinds of internal fittings and furniture. Things last longer and look better in every way. This dust-collecting system actually tends to get its own time of operation down to the minimum because there is less dust to be removed each day in any car which is constantly cleaned by the vacuum process, than can possibly be with cars which are handled in the usual way. The new system is economical all round the clock. It is sanitary and it is a dust remover which removes dust.

END VIEW, ERIE STEEL BAGGAGE CAR.

Costly Tourists.

The Canadian Pacific has turned out a set of twenty-four new tourist cars from their car shops at Hochelaga, a suburban part of Montreal. The cars are 80 ft. long, 14 ft. 7 in. high and 10 ft. wide. They weigh about 120,000 lbs. They are said to be the most costly tourist car on this Continent. The outside is the regulation C. P. R. mahogany finish, that is just varnished. Inside they are finished in cherry and curly birch stained and rubbed to a piano polish.

The main body of the car is divided into 14 sections. There are three toilet rooms, a smoking room and a kitchen. The seats are covered with leather and springs are used in the upper and lower births. The unique feature is the kitchen, which contains a range, ice water tanks, sink and cupboards. The cars are heated with steam in accordance with the company's practice, but the Baker heaters which are supplied with steam through a commingler, can be used with fire in the usual way in case of emergencies. The cars are lighted with acetylene gas.

The idea of the tourist cars is to provide first-class accommodation at modern prices to people who have long journeys to make and who carry or buy their own provisions but need facilities for cooking, etc. In all essentials these cars are said to be as comfortable as the regular sleeping car.

Box Cars Lifted While You Wait.

There is a wrecking crane on the Nashville, Chattanooga & St. Louis which the local papers say cost about $15,000, and this piece of machinery, which thinks nothing of lifting an ordinary locomotive, is to be seen on a siding near the Union Station at Chattanooga, Tenn. It weighs about 162,000 lbs., and is intended to pick up anything which may temporarily obstruct the track between Atlanta and Chattanooga, and between Chattanooga and Nashville. Its lifting capacity is said to be 75 tons. The length of the car is 24 ft. and the crane arm is 28 ft. long.

It is true that in dealing with an extra heavy locomotive, if it should have to attempt the task, it might be compelled to make "two bites of a cherry," so to speak, but it could clear the road by lifting first one end and then the other, and anyone who has had even an elementary acquaintance with train wrecking knows how much can be done with one-end lifts judiciously managed. As for ordinary box cars, this crane does not even argue with them, but can "tackle" any one of them and make a sure goal kick every time.

The "Large Car" in Great Britain.

The United States consul at Nottingham, England, reports that the Great Central Railway, which runs from London to Liverpool via Nottingham, is taking the lead in the matter of steel car equipment. The Great Central steel car is 41 ft. 2¾ ins. long, 8 ft. 3 ins. width and 8 ft. 8 ins. high. This is the largest freight car ever used in the United Kingdom. It is an all-steel car and has a capacity of 40 long tons, or about 44¾ of our tons.

As these cars are so much heavier than other cars on the same road, they have been equipped with specially designed buffers. They have also vacuum brakes and effective "either side" hand brakes. The car weighs light about 33,544 lbs. and is about four times larger than the present style of cars used in Great Britain. When our friends across the ocean become fully convinced of the advantages of the "large car" for certain kinds of traffic which they handle, we may expect to hear of the Great Central's lead being followed by other roads.

All-Steel Baggage Car for the Erie.

These illustrations are made from snapshots of the new all-steel baggage car built for the Erie Railroad by the Standard Car Company of Pittsburgh. The car was built at the Butler, Pa., shops, and in general follows the Standard Company's box car form of construction.

The sides of the car are made of plate steel and what may be called side sills are composed of two angles riveted, one flush with the bottom of the plates and the other some few inches above it, with the car plates forming the web between them. The floor plates of the car rest upon the upper side of the top angle iron.

ALL-STEEL BAGGAGE CAR FOR THE ERIE.

The center sills are really steel girders made of plate with two angle irons at the edges riveted one to each side. They are deep in the center and taper toward the ends, thus giving an exceptionally strong form of construction. Two cross diaphragms of steel girder construction take the place of ordinary needle beams. The web of each diaphragm passes through the webs of the center sills and four angle irons are riveted up along the plane of intersection.

The roof plates are all butt joints united by the flat side of the angle iron carline. The car, of course, is not inflammable, it cannot be crushed and generally speaking, it appears to be a "wreck resister," of which builders and owners may feel justly proud.

Steel Cars in the New York Subway.

The construction of the all-steel cars used on the Subway Division of the Interborough Rapid Transit Company, in New York, are interesting examples of new designs worked out in material not hitherto used for such a purpose.

One of the cars weighs about 34,000 lbs., not including the trucks. The motor truck weighs 12,240 lbs. and the trailer 8,400 lbs., which makes the total weight on the track of 55,040 lbs. for each such vehicle.

The center sills are structural steel, 6-in. I-beams, and the side sills are 5x3x½ ins., with the short flange underneath and parallel to the ground. There are no separate platform members, the sills are carried out to the curved end sills and the vestibules are thus virtually part of the car body. The end sill is a curved angle bar 6x3½x½ ins. It is secured to the sills by steel brackets and a plate riveted firmly to each. The buffer beam is a curved piece of white oak, tapering at each end, and it is bolted to the end sill with protecting plate on the outside.

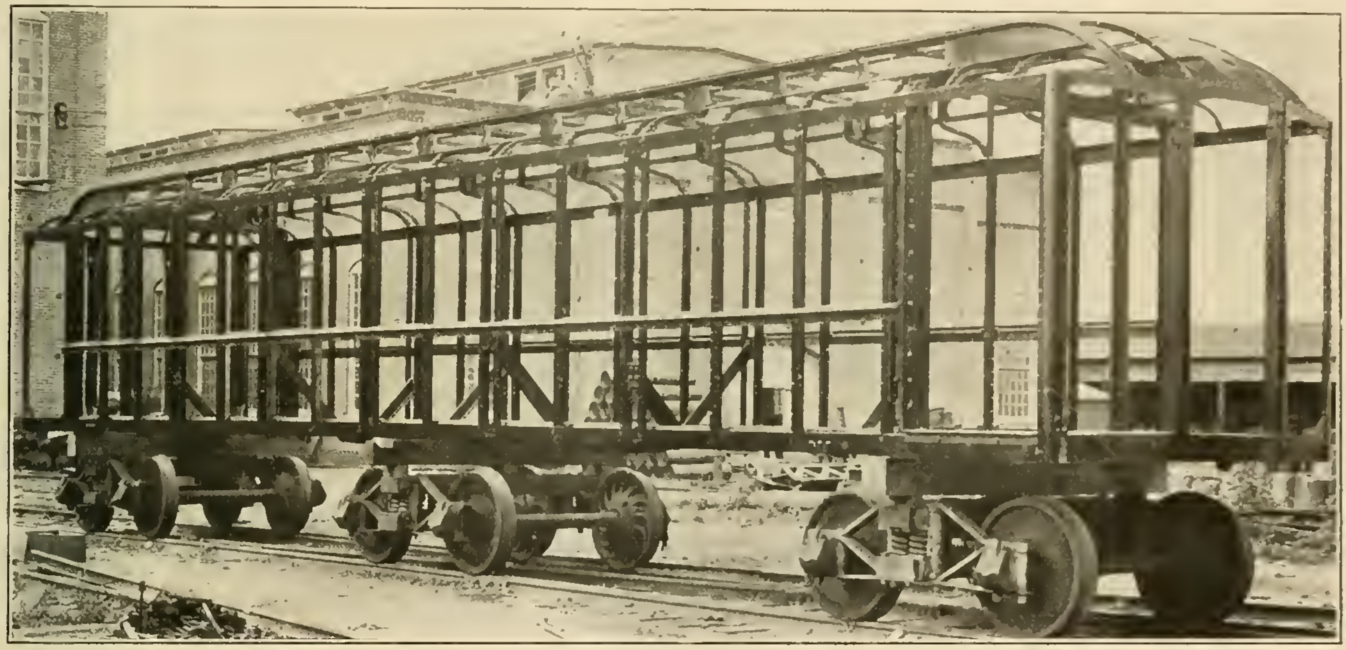
The floor of the car is composed of corrugated galvanized plates riveted to the floor angles. Upon this corrugated surface a preparation known as "monolith" is layed, which is held by numerous clips in the floor. The monolith cement hardens into a dry rock-like substance which is entirely fireproof. Strips of ash wood are laid on the monolith, which latter form the wearing surface upon which passengers tread. The platform floors are steel plates covered with rubber matting.

The roof is made of "composite" board, covered with canvas and painted. Copper sheeted eaves are used to finish the edge of the roof. Composite board is a hard, light, fireproof material made of paper pulp and to this board the aluminum head-lining is cemented. An aluminum moulding is used as a finish along the top of the windows, and, in fact, the use of aluminum in various parts of this car reduced weight by about 1,800 lbs.

The single window posts are made of T's, and the double ones of two angles placed back to back so as to make a T. Aluminum castings are used for the window stops and filling pieces. The seats are made of rattan and are placed on pressed steel frames. As there is, of course, exceedingly little clearance in the subway, the lower sashes of the windows are fitted in permanently so that they cannot be raised, but the upper sashes can be lowered for ventilation purposes. The motorman's box is made by closing all the doors on the front platform. The end door when shut, opens up for use, the master controller, the air brake valve, etc.

The wiring of these cars has been carried out in a very workmanlike manner. All electric conductors are encased in an insulating medium which tightly fits the interior diameter of smooth iron pipes. When the wires are in place there is no possibility of their shaking or chafing. The interior of each pipe used in this work is smooth, the ends are carefully reamed out so that no obstruction or rag of metal which might injure the wiring, is left at the pipe ends.

Each car has one motor truck with two 200 h.p. motors. In these trucks the outer pedestals can be readily removed so that the wheels can be changed without much trouble. The electric lighting of the car is performed by the illumination of twenty-six 10-candle power lamps on each side and six in the center of the clearstory, making 58 lamps in all. There are seats for 52 persons, sixteen can be accommodated in cross-seats and 36 in those placed along the walls.



VIEW OF FRAME FOR ALL-STEEL PASSENGER CARS IN NEW YORK SUBWAY.

Fire Fighters on the Chicago Elevated.

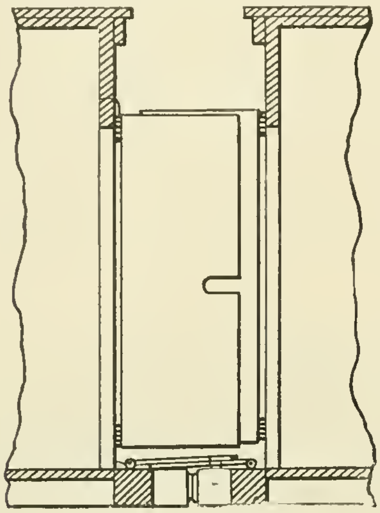
A new style of car has lately been put into commission by the Metropolitan Elevated Railroad people in Chicago. These cars are nothing more or less than fire fighters and intended to protect the company's property from fire risks. The cars have been covered with metal in order to enable them to approach closely to a fire. They are equipped with twin chemical fire extinguishers which are able to give a good account of themselves when brought into action at close range. The idea is to place one of these cars at each yard on an easily accessible track so that when an elevated fire fighter is wanted it can be got at and moved without loss of time. These blaze destroyers may be regarded as even more important than a wrecking outfit because when wanted they are wanted "bad."

Temporarily Permanent.

A case was tried not long ago in one of the Chicago courts in which it was held that a railroad car if temporarily not movable was "a permanent residence" as far as registration for the purpose of voting at an election was concerned.

A railroader registered and designated a certain car on a side track as his "residence," but the board of revision struck his name off the list on the ground that a movable affair like a railroad car could not be considered as a permanent residence.

When the matter came before court



SIDE VIEW OF VESTIBULE FOR STOCK CARS.

it turned out that the siding on which the car then stood had been disconnected with the main line and the car could not be moved until the missing track was restored. The man worked in the maintenance of way department and this was the company's method of giving him a house. The fact that it was on wheels did not weigh with the court, which held that as the car temporarily could not be moved it was under the circumstances a permanent residence. The man voted all right.

Vestibule Stock Car.

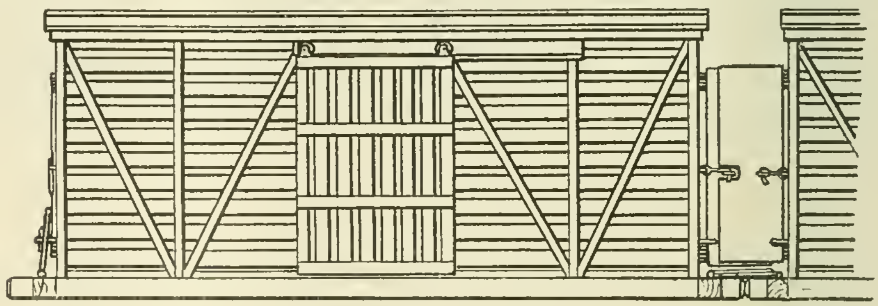
The vestibule stock car, of which we give some illustrations, was designed by Mr. W. A. Buckner, train despatcher of the Gulf, Colorado & Santa Fe Railway, at Cleburne, Texas.

The object of vestibule stock cars is in general to provide a simple means by which they can be loaded from the end and the animals passed along from the front of a train to the last car without requiring the services of a switching engine to shift each car when it becomes full.

The vestibuling is accomplished by providing the stock cars with a pair of end doors which open outward, and under them what is practically a platform, can be let down so as to make a through passage. When this is done on two adjacent cars which have been coupled together the open doors and the platforms overlap a certain amount so that a continuous and enclosed floorway exists between them. A train of such cars can be loaded with a minimum of trouble or expenditure of time. All the animals enter from one end and pass through the cars until the last one is reached, and as soon as it is full the end doors are closed, the platform is swung up and locked and the next car to the last is the one to be filled up. Meantime a single file of animals passes in through the doors at the front end of the train. If the animals are of a docile nature they can probably be loaded almost as quickly as passenger cars are usually filled by human beings.

When the vestibule doors are open they are secured in position by two iron rods which are fastened permanently to the end sills and which have hooks on their other ends which easily drop into staples on the doors. Sufficient play is allowed between staples and hooks to permit the doors to overlap and not come rigidly in line when they are swung open opposite each other.

The platform is hinged at the end of the car and opens down to a horizontal position. Supports are arranged under the platform in the shape of a transverse beam on each end of the car with chafing blocks which butt up against those of the next car. These supports serve the purpose of maintaining the platforms in a horizontal position and also with their chafing blocks preventing the cars being pushed together sufficiently to cause any damage to the doors or platforms. These chafing blocks are similar to the buffers used on many roads, and the transverse beams and the chafing blocks form a solid support which practically extends entirely between the cars and serves as a bed upon which the platforms rest when in their lowered positions fully capable of supporting the weight of the animals which are expected to walk over them.

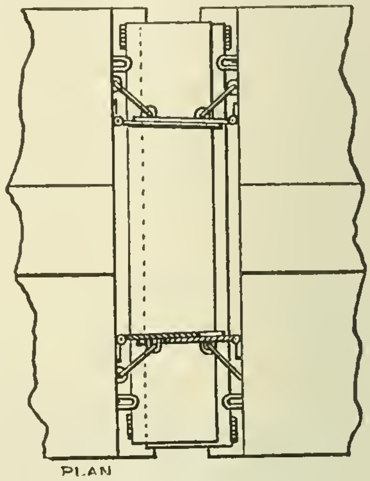


VESTIBULE STOCK CAR.

When the end doors are closed and fastened the platforms shut up against the outside of the doors, and when secured as they are with staples and pins cannot become unfastened or kicked open by the animals within. It is safe and sure and there is nothing complicated about the whole arrangement. Mr. Buckner's design is covered by patents.

Getting to be Important.

Poquonoc is rather a strange word, and it might almost do for the name of a Pullman car, but what Poquonoc is going to be famous for is that when all the railroad work has been done there, which has been proposed, it will have one of the largest freight car yards in the New England States.



PLAN OF VESTIBULE FOR STOCK CARS.

Poquonoc is situated about four miles east of New London, and is on the line of the New York, New Haven & Hartford. New London is in the state of Connecticut, on the Sound, and is about opposite the western end of Long Island. There are about twenty miles of track in the new yard and a coal handling plant capable of holding 2,400 tons has been built. Coal will not be touched by the shovel from the time it leaves the mines in Pennsylvania until it is shoveled into the firebox of a locomotive by the fireman.

Not far from the coal handling apparatus a refrigerating plant has been put in where cars containing perishable freight can be quickly re-iced. About three thousand cars can be accommodated in the Poquonoc yard. This quiet little village is destined to become an important railroad distributing point, and a very substantial increase in population is looked for.

Of Personal Interest.

Chicago Office Closed.

Our Chicago office has been closed and in future the only address of Railway and Locomotive Engineering will be 136 Liberty street, New York. The dual address caused us considerable inconvenience, through correspondence getting mixed up between the two sets of offices.

Mr. A. W. Horsey, formerly chief draughtsman on the Canadian Pacific Railway, has been made mechanical engineer for line east of Port Arthur on the same road, with office at Montreal, Que.

Mr. S. C. Parker has been promoted to the position of traveling engineer on the Alabama Great Southern Division of the Queen & Crescent Route, with headquarters at Birmingham, Ala.

Mr O. C. Breisch, formerly foreman of the Lake Erie & Western Railroad shops at Tipton, Ill., has been promoted to the position of general foreman in charge of shops and roundhouse at Rankin, Ill.

Mr. J. J. Mailor, Jr., has been appointed foreman of the machine shop of the Fort Smith & Western Railroad, at Fort Smith, Ark., vice Mr. A. A. Ashcroft, assigned to other duties.

Mr. James H. Maddy, who was formerly connected with the general manager's office on the Baltimore & Ohio, has been given charge of the now re-established press bureau of that road. Mr. Maddy's many friends will welcome him back to his old place.

Mr. T. A. Laws, formerly superintendent of motive power of the Chicago & Eastern Illinois, has been appointed mechanical engineer of the New York, Chicago & St. Louis Railroad Company, with office at Cleveland, Ohio, vice J. T. Carroll, resigned.

Mr. E. W. Fitt, heretofore chief draughtsman of the Chicago, Burlington & Quincy, for lines west of the Missouri river, has been appointed assistant superintendent of motive power, with office at Lincoln, Neb.

Mr. E. E. Davis, formerly assistant superintendent of motive power of New York Central & Hudson River Railroad, has been appointed superintendent of motive power on the Buffalo, Rochester & Pittsburgh, vice Mr. F. T. Hyndman, resigned. Mr. Davis' office is in Du Bois, Pa.

Mr. J. Markey has been appointed master mechanic of the Northern Division of the Grand Trunk Railway System, with headquarters at Allandale, Ont., vice Mr. N. B. Whitsel, resigned.

Mr. W. T. Noonan, who was on December 1, selected as general superintendent of the Buffalo, Rochester & Pittsburgh Railroad, is a young man who gives much promise as a strong transportation official, who will give a good account of himself in his new position. Though a young man he has been in active railroad work for nearly twenty years, and is well known in railroad circles throughout the country. Lately he has been connected with some of the leading railroads in the United States and has shown executive ability of such a high order that it has attracted much notice from high railroad officials.

MR. W. T. NOONAN.

He was for some time superintendent of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., where the writer first met him, and being attracted by his bright incisive manner, asked to be kept advised of his progress in the railroad world. Some time since he was with the Delaware, Lackawanna & Western Railroad, which he left to accept a position with the Erie, and which he has recently resigned to accept the position to which he was appointed on the Buffalo, Rochester & Pittsburgh Railroad.

He has been a good friend to Railway and Locomotive Engineering, and has been a constant reader and subscriber for the past twelve years, and has a large acquaintance with engineers and mechanical men. He started in a subordinate position and has gone through every branch of the operating department and has been a deep student of operating matters and methods all his life. We are glad to see our friend go higher up the ladder of fame and we wish him all possible success in his new field.

Mr. R. C. Hallett has been appointed railroad sales agent, representing the Kenney Vacuum Sweeping System, of 72-74 Trinity Place, New York City.

Mr. M. B. Cutter has been appointed general manager of the Lehigh Valley with office at South Bethlehem, Pa., and 143 Liberty street, New York. The position of general superintendent has been abolished.

Mr. R. M. Crosby has been appointed superintendent of the South Tacoma shops of the Northern Pacific. Mr. Crosby was formerly master mechanic of the Chicago Great Western.

Mr. J. E. O'Brien, formerly master mechanic of the Dakota Division of the Northern Pacific, at Jamestown, N. D., has been appointed assistant superintendent of the South Dakota shops of the same company.

Mr. R. P. Blake, formerly mechanical engineer of the Chicago, Milwaukee & St. Paul Railroad, has been appointed assistant superintendent of the Brainerd shops of the Northern Pacific.

Mr. A. L. Sanger, purchasing agent of the Pere Marquette, has had his jurisdiction extended over the Cincinnati, Hamilton & Dayton, vice C. A Parker, deceased. Mr. Sanger's office is in Cincinnati, Ohio.

Mr. P. H. Houlahan, hitherto superintendent of Hannibal & St. Joseph Railroad at Brookfield, Mo., has been appointed general superintendent of the Toledo, St. Louis & Western (The Clover Leaf Route), vice Mr. R. Williams, resigned. Mr. Houlahan's office will be in Frankfort, Ind., the headquarters of this division having been moved from Toledo. He is the author of the well-known work, Houlahan's Railroad Hand Book, which is a practical hand book of information for young men intending to enter or who have entered railroad service.

Mr. James Driscoll, formerly foreman of the Palo Alto roundhouse on the Philadelphia & Reading Railroad, has been appointed general foreman of all the company's shops at that point.

Mr. George A. Carter has been appointed roundhouse foreman of the Palo Alto shop on the Philadelphia &

Reading, vice Mr. James Driscoll, promoted.

Mr. Martin C. Riley, who has been for a number of years employed in the Oneonta, N. Y., shops of the Delaware & Hudson Railroad, has been appointed foreman of the Albany shops of the same company, vice E. J. Brooks, deceased.

Mr. R. H. Rutherford has been appointed assistant master mechanic of the Mexico Division of the Mexican Central Railroad, with office at Aguascalientes.

Mr. H. C. Burk, master mechanic of Mexico Division of the Mexican Central Railroad, has been transferred from Aguascalientes to Mexico. All reports formerly made to assistant superintendent machinery will be made to master mechanic of Mexico Division unless otherwise ordered. Mr. G. W. Jennings, assistant superintendent of machinery, having resigned, the position has been abolished.

Mr. S. J. Delaney has been appointed master mechanic of the Hudson River, Harlem and Putnam Divisions of the New York Central System, with headquarters at Mott Haven, N. Y.

Mr. Richard Koehler has been appointed general purchasing agent of the Oregon Railroad & Navigation Company, and the Southern Pacific Company's lines in Oregon, with headquarters at Portland, Ore. The office of purchasing agent and the office of manager Southern Pacific Company's lines in Oregon have been abolished.

Mr. James L. Cunningham, the new general foreman of the Pennsylvania Railroad shop at Columbia, Pa., was born at West Fairfield, Pa., September 28, 1874. He graduated from the Blairsville, Pa., high school in the summer of 1890, and in December, 1891, he entered the P. R. R. machine shop, at Altoona, Pa. He was later employed as machinist on special work until the fall of 1896, when he entered the Mechanical Engineering class at Purdue University, graduating in 1900. During the summer months from 1896 to 1900, Mr. Cunningham was employed on special duty of various kinds for the Pennsylvania Company. After this he was employed from February, 1901, to December, 1902, as inspector at the erection of the Union station power plant, at Pittsburgh, Pa. The next year he held the position of foreman of the Bedford shops of the Bedford Division of the P. R. R. Later on he was promoted to be assistant master mechanic of the Harrisburg shops, beginning with December, 1903. He held the latter position until November 1, 1904, when he was again promoted and became general foreman of the Columbia shop.

Mr. J. J. Shaw has been appointed division foreman of the St. Louis & San Francisco at Neodosha, Kan., vice Mr. C. E. Brown, transferred.

Mr. C. E. Walker has been appointed foreman of the car department of the Houston & Texas Central, with office at Spencer, Tex.

Mr. M. J. McGrath, master mechanic on the Illinois Central Railroad, at East St. Louis, Ill., has been transferred to Clinton, Ill., in the same capacity.

Donald Sinclair.

Donald Sinclair, a brother of our chief, died at Kankakee, Ill., on December 15, of Bright's disease. Mr. Sinclair has been for years head of the Sinclair Construction Company, of Chicago, which

DONALD SINCLAIR.

was engaged in general contracting, the greatest part of the work having been done for the Illinois Central Railroad Company. He was born in Scotland in 1843, the son of a railway man, whose greatest aim in life was to give his children the best education his means afforded. Donald learned the blacksmith trade, but his health failing over the forge, he went to work for a firm of contractors as assistant to the engineers on the locating part of the Caledonian Railway. Civil engineering became his chosen profession, and he showed much perseverance and self-denial in studying the principles of the business. He progressed rapidly and soon pushed himself into important positions in which he came to conduct several important engineering enterprises, among them the constructing of a tunnel to Loch Katrine for the water department of Glasgow. Wishing to go into business for himself he came to this country in 1887 and shortly afterwards went to work for the Illinois Central as inspector of tunnel work. He associated himself with others in forming the firm Meysenburg, Wright, Sinclair & Carey, and took a large contract on the Chicago Drainage Canal, which brought more repute than profit. Since that time he confined his operations to the Illinois Central and the Southern Railways.

During his working career Donald Sinclair used more than fifty thousand tons of dynamite and other high explosives without any accident. He was a most energetic and capable engineer, and Mr. Wallace, who is now chief engineer of the Panama Canal, when general manager of the Illinois Central, always favored giving contracts to Donald Sinclair because he could depend on them being finished at the time agreed upon. His call was quite sudden and he leaves a wife, one son and two daughters.

Mr. J. R. Groves has been appointed superintendent of motive power and car department of the Denver & Rio Grande, vice Mr. F. Mertsheimer, resigned.

Mr. J. H. Nash has been appointed master mechanic of the Illinois Central at East St. Louis, vice Mr. J. McGraw, transferred.

Mr. Gustavo Navarro has been appointed superintendent of motive power and machinery of the Vera Cruz & Pacific, with headquarters at Tierra Blanca, Mex.

Mr. R. W. Baxter has been appointed superintendent of the Wyoming Division of the Lehigh Valley, vice Mr. T. H. Pindell, promoted.

Mr. T. H. Pindell has been appointed superintendent of transportation of the Lehigh Valley Railroad, with office at South Bethlehem, Pa. All reports and communications heretofore addressed to the superintendent of car service will hereafter be made to the superintendent of transportation.

Mr. F. J. Pease, until recently general foreman of the Michigan City shops of the Michigan Central, has been appointed general foreman of the Lima, Ohio, shops of the Lake Erie & Western.

Mr. Chas. H. Quereau, formerly superintendent of the West Albany shops of the New York Central, has been appointed engineer of tests for the same company, with headquarters at Albany, N. Y.

Mr. W. R. Maure has been appointed mechanical engineer of the New York, New Haven & Hartford Railroad, with headquarters at New Haven, Conn.

Mr. O. M. Godfrey has been apointed master mechanic of the Washington & Columbia River Railway, with office at Hunts Junction, vice Mr. J. D. Jones, resigned.

Mr. Thomas O. Cole has been appointed car accountant of the Lehigh Valley Railroad, with office at South Bethlehem, Pa. The position of superintendent of car service is abolished.

Mr. C. W. Kinney has been appointed superintendent of the Pennsylvania Division of the Lehigh Valley Railroad, vice Mr. R. W. Baxter, transferred.

Mr. Marvin Hughitt, president of the Chicago & Northwestern Railway, is one of the most thorough masters of details of officials connected with railway management in the country. His road is noted for absence of serious accidents, a condition brought about by rigid discipline and the use of first-class safety appliances. There are over 1,700 stations on the system, with a tributary population of more than 7,500,000 people, reaching almost every community of importance in nine of the Western States. Now, the question of thorough discipline of the big army of employees required on a road like that is one that's enough to stun the average man. They tell me that on the Northwestern line they maintain no less than 610 electric block signals, 126 interlocking plants, over 9,000 miles of telegraph line, over 40,000 miles of wire and a force of 1,700 telegraph dispatchers and operators in the movement of their traffic. Besides this there is an army of crossing watchmen, operators of safety gates, signal tower men, track walkers, in short, a highly organized system looking after the safety of patrons. Their widely announced only double track to the Missouri river is one of the most aggressive moves ever mdae by a railway, and one the bearing of which upon the question of safety is obvious.

The resignations of S. B. Floe'er, superintendent of the north and south divisions of the Cincinnati, Hamilton & Dayton Railroad, with headquarters at Dayton, and of W. C. Shoemaker, superintendent of Indianapolis and Springfield division, with headquarters at Indianapolis, have been received by General Manager Edson. Their successors will be R. H. Bowren, who takes the place of Mr. Floeter, and H. E. Whittenberger, who will have charge of the Indianapolis and Springfield division. Both of the new men were formerly with the Denver & Rio Grande Railroad, Mr. Bowren at Pueblo and Mr. Whittenberger at Alamosa.

Mr. Edward D. B. Brown, has resigned as architect of the Lehigh Valley Railroad Company, to accept the position of contracting engineer of the Fairbanks, Morse & Co., of Chicago, Ill. The work on the new repair shops of the Lehigh Valley Railroad Company, at Sayre, Pa., on which Mr. Brown has been engaged for the past two and one-half years, is practically completed, which work he has been directly identified with.

Mr. C. M. Mendenhall has been placed in charge of the engineering department of the American Steel Foundries and has the title of chief engineer. Mr. Mendenhall's office is in New York and the mechanical engineer, the traveling engineer and the constructing engineer of the company will report direct to the chief engineer.

Mr. W. J. Schlacks has been appointed superintendent of machinery of the Colorado Midland Railway, with headquarters at Colorado City, Col., vice Mr. J. R. Groves, resigned. Mr. Schlacks is a son of Mr. Henry Schlacks, who was for many years superintendent of motive power of the Illinois Central and later of the Denver & Rio Grande.

MR. W. J. SCHLACKS.

He is a graduate of Stanford University and has held important positions in the mechanical department of the Denver & Rio Grande and the Colorado Midland previous to his promotion on the latter road.

Dr. Andrew Carnegie is engaged writing a life of James Watt, who is regarded by the famous steel maker as one of the greatest heroes of industrial invention. Dr. Carnegie is devoting a vast amount of investigation to the life and times of the great improver of the steam engine and we anticipate the production of a master work. Dr. Carnegie has written several books that display strong originity of thought and conception with wonderful descriptive power. If he had made literature his life's work the likelihood is that Andrew Carnegie would have been as famous as a writer as he is as a man of affairs. We feel sure that Dr. Carnegie will produce a highly interesting life of James Watt, but we cannot help regretting that he did not choose for a subject history of the "Growth of American Iron and Steel Industries." He could have written up that subject better than any man living.

Reducing Cost of Shop Work.

From a blue print showing comparative cost of motive power expenses on the Kansas City Southern Railway we are moved to congratulate Superintendent of Machinery W. E. Symons on the record he is making. Mr. Symons always has been noted as a hustler who arranges facilities so that workmen can do their best.

During the first month of Mr. Symons' management the increased shop output amounted to 28 per cent., the second 71 per cent., and the third 57 per cent., while in the third month there was a reduction in pay rolls of nearly $8,000, and a total money gain of over $8,000.

The cost of overhauling locomotives was reduced from an average of $1,770 last year to $1,366 last month, or a reduction of 23 per cent., while the cost of lubrication of locomotives has been reduced from $3.34 per thousand miles to $2.17, a reduction of 35 per cent. in a little over ninety days. The engines are running cooler, are much cleaner, and give much better service than when the engines and cross ties were both bathed in oil. Numerous other economies have been effected, which would doubtless interest our readers, but their recital would involve voluminous detail that we cannot publish at this time.

No Consolidation of Mechanical Associations.

For a long time there have been periodical agitations among certain persons to consolidate the Master Car Builders' and the American Railway Master Mechanics' Associations and outside talk frequently intimated that the consolidation was on the eve of being consummated. A curious thing about these agitations has been that they originated almost entirely among people who were not members of the associations and were carried on by publications that were not quite friendly to mechanical railway men.

The move was worked up so industriously lately that a joint committee of the two associations was appointed to report on the question and to make recommendations for effecting the consolidation. This committee held a meeting last month and the subject of consolidation was discussed in all its bearings. After the members had done talking a vote was taken and every one voted against making any change. That ought to stop the talk of consolidation for two or three years.

Baldwin Tank Engine for the Wellington & Manawatu.

The engine here illustrated is a suburban tank 2-8-4 type and it runs on a track 3 ft. 6 ins. wide. The cylinders are 17x20 ins. and the main valves are of the piston type. The driving wheels are 43 ins. diameter and the two central pairs of driving wheels are not flanged.

The pistons drive on the third axle from the front and this axle also carries the eccentrics. The eccentric rods are necessarily short, and from the link block extends a U-shaped transmission bar which passes around the axle of the second pair of drivers and the valve motion is indirect.

The boiler is a straight top one and measures 54 ins. in diameter at the front end, and when the heating surface of firebox and tubes are added together it gives a total of 1,080.34 sq. ft. The grate area is 16.58 sq. ft. The tubes are 1¾ ins. in diameter and are 11 ft. 7 ins. long, and there are 188 of them. There are three washout plugs equally spaced along the bottom center line of the boiler. The firebox is made of copper sheets and the boiler tubes are of brass.

The water is carried in two tanks, one on each side, and these are connected underneath by pipes which pass across under the boiler. The total water capacity is 1,200 U. S. gallons. The main reservoir is carried under the fuel box at the back of the cab. The wheels of the rear truck are 26 ins. in diameter, while those of the pony in front are 30 ins. The pony and the first pair of drivers are equalized together, the next three pairs of drivers are equalized together and the rear truck is an ordinary engine truck with equalizers and inside journal bearings. The cab is all steel and is as roomy as it can be made under the circumstances. The whole machine has a solid, and one might almost say a chunky, appearance.

A few of the principal dimensions are appended for reference:

Boiler—Material, steel; thickness of sheets, ½ in.; working pressure, 200 lbs.; fuel, soft coal; staying, radial.

Fire Box—Length, 81⅝ ins.; width, 29¼ ins.; depth, front, 54¼ ins.; back, 51¾ ins.; thickness of sheets, sides, ½ in.; back, ½ in.; crown, ⅝ in.; tube, ⅞ in. and ⅝ in.

Water Space—Front, 3½ ins.; sides, 2¾ ins.; back, 2½ ins.

Driving Wheels—Journals, main, 7 x 7 ins.; others, 7 x 7 ins.

Wheel Base—Driving, 11 ft. 9 ins.; rigid, 11 ft. 9 ins.; total engine, 29 ft. 5 ins.

Weight—On driv. wheels, 84,290 lbs.; on truck, front, 13,000 lbs.; back, 21,100 lbs.; total engine, 118,390 lbs.; total engine and tender, about 142,000 lbs.

SUBURBAN SERVICE, 2-8-4 ENGINE FOR THE W. & M.

Baldwin Locomotive Works, Builders.

"Better the Day—Better the Deed."

Thanksgiving day witnessed a record run made by the Cole four-cylinder compound, belonging to the New York Central, on the Pennsylvania testing plant, at the St. Louis Exposition. This engine ran "as fast as she could turn a wheel," and did not move as much as 3/16 of an inch ahead while working hard for an hour. The drawbar pull was equal to that required to draw five full sized, heavy Pullman cars at a rate of 75 miles an hour and the driving wheels turned round 320 times every minute. That means that in the time allotted they just whirled 19,200 times.

In most of the previous tests about 260 revolutions per minute was about all that some of the engines could do without runing hot. Three tests were made with this balanced compound. In the first test she made 57 miles per hour for two hours and on the next occasion she got away with 66 miles per hour for one hour and a half, but on Thanksgiving day she showed her appreciation of the occasion by giving a 75-mile run in 60 minutes without any perceptible vibration. It was a notable day and a notable record.

The Steam Locomotive May Last a Few Weeks Longer.

The electric locomotive belonging to the N. Y. C., which was illustrated in the December issue of RAILWAY AND LOCOMOTIVE ENGINEERING, is being subjected to still further tests and will be carefully watched by expert investigators for a little while longer before practical men bid a tearful good-by to the steam locomotive of our youth, as the non-technical press of this country seem ready and even anxious to do.

Wind resistance is being investigated and the rolling friction of the machine itself is being looked into. The power necessary to drive it along the track in good and bad weather conditions is the subject of cold-blooded experiment with accurate recording apparatus. Moving pictures showing the electric locomotive heavily loaded and easily running away from steam locomotives of the latest design running light, are not expected to cut very much scientific ice with men who are engaged in "counting the cost."

Electrical connection not only between the third rail and the contact shoes is esential, but electric connection between the driving wheels and the track rails is necessary in order that the proplusion current may be properly "grounded." The electric locomotive needs a front truck as an ice cracker, like its steam rival; it has to clean the third rail before it can run along, and for this purpose chloride of sodium has to be carried in tanks and sprayed on the rail. This substance with the chemical name is sometimes called "pickle," but it is common salt and water when all is said and done, and in sleety weather the electric locomotive is usually kept very busy gettting over the road and that is when the moving pictures are not usually taken.

In a snow storm the third rail likes to hang on to the snow and ice as well as any other kind of rail unless it is properly protected and effectually cleaned, and this subject is being taken up seriously by those who have to "pay the piper." In fact, the whole idea of the New York Central people and the General Electric Company is not to secure a snapshot verdict in favor of the electric locomotive, but to find out exactly "where they are at" by tests which will leave no room for doubt as to efficiency of operation and the number of dollar bills necessary to deliver the goods, under all conditions.

High Fares and Strange Service on the Congo State Railway.

The Congo State Railway is certainly a unique road according to a lately returned missionary from West Africa who has traveled over the line. It is about 260 miles long and runs from a place called Matadi at the mouth of the Congo river to Stanley Pool. A trip occupies 24 hours.

There are two classes on the road, a first and a second, but no mixing up ever occurs as all the whites must go first class and the natives must all travel second class. This being the case, the company does not waste its revenue printing railroad tickets. You pay according to your color and get aboard.

THE FIRST AND SECOND CLASS CARS.

The fare for whites is 500 francs ($100) and for natives 50 francs ($10).

The train consists of a first class, a second class carriage and a luggage van. The first class is about the size of one of our horse cars and is furnished with small and uncomfortable chairs. The second class is practically a gondola with low sides and the luggage van is another of the same kind. Passengers' baggage is put in the last car and canvas is stretched over it to keep out the wet.

This train is the whole stock in trade

THE TRAIN ON THE CONGO STATE RAILROAD.

of the railway and they run this train down one day and up another. This arrangement has the advantage that no train dispatcher or rules or block signals are necessary. In fact the whole thing is the famous train staff system out and out.

The road goes through the Pallaballa mountains by what is usually described as a "tortuous route," and when it gets to the summit it is about 17,000 ft. above sea level. The grade is about 150 ft. per mile and the brake equipment is "ordinary."

The fare charged amounts to a little less than 40 cents per mile, but those who do not care to pay the amount can make the journey in three weeks traveling through the woods accompanied by guides. Notwithstanding all this the company's freight and passenger traffic is excellent. The road is an example of one of the greatest engineering achievements in the world and some years' hard work was required for its construction. Although the Belgian government imposes a heavy duty on the operation of the road, the annual dividends yielded to the stockholders are very large and the company's stock cannot be bought.

The Richmond Compound.

BY H. C. ETTINGER, AIR BRAKE INSTRUCTOR, WABASH RAILWAY.

(*Continued from page 562, ante.*)

PORTS.

Beginning at the small pipe connection in the smoke arch it will be found this live steam way through the low pressure cylinder saddle extends down some fifteen inches, thence ahead along the side of the receiver cavity fifteen inches where it again turns, going about seven inches toward center of saddle, at which point it connects with live steam way in the intercepting valve casing. Before accepting or doing any work on this cylinder casting, ascertain condition of the previously described port, otherwise the cylinder may have to be rejected later, as an engine with this small port strictured would not work simple with any degree of satisfaction. neither would such engine start promptly in case it was standing on the center on the high pressure side. In fact, should this port be closed entirely, the engine would not work simple, neither would such engine start when standing as before described. It should also be noted that the live steam way in the intercepting valve casing is fully open before applying such casting, as several cases have been found where the slipping of core had bridged this orifice, causing much trouble before finally discovered.

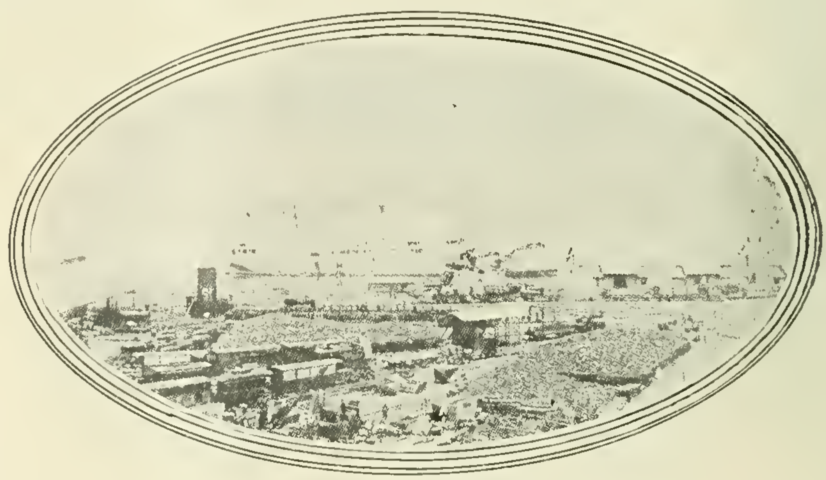
The foregoing defects have the same effect as a reducing sleeve stuck in the compound position, namely, no steam will be admitted direct from boiler to low pressure steam chest. Such engines are quite deceiving to some in as much as they will start, providing they are not on the center on high pressure side. In fact, no trouble will be experienced until attempt is made to work the engine simple or start her when standing on the center on high pres-

CONGO RAILROAD STATION AT MATADI.

sure side. The prudent engineer or foreman will not be deceived in such an engine, even though she does start, as the sound of the first exhaust will tell whether steam is being supplied direct from boiler to low pressure side or from high pressure exhaust. For instance, if the live steam ways were open, the 40 per cent. boiler pressure admitted would cause the first exhaust to be good and strong, whereas if no live steam was admitted the first exhaust would be decidedly weak, owing to there being nothing but exhaust steam from the high pressure side. In other words, taking a boiler pressure of 200 pounds, the reducing sleeve would admit 80 pounds to the low pressure side, causing the first exhaust to be loud. But were no live steam admitted, only the exhaust pressure from the high pressure side would be had. This, after expanding into the receiver, low pressure chest and cylinder, would not exceed 15 or 20 pounds, hence a weak exhaust at start.

To ascertain if live steam ways and port to low pressure steam chest are open, set the brake or block the engine, hold the relief valve on low pressure chest open while opening the throttle. If the aforesaid steam ways and port are open, live steam will at once be blown from the relief valve. If there is no escape of steam from the relief valve when making this test, remove the dash-pot head at once and ascertain if trouble is caused by the reducing sleeve sticking or for other reasons.

If the dash-pot piston is found clear ahead (in the compound position), it shows the reducing sleeve being inoperative has failed to automatically move to starting for simple position, in which case it should be treated as hereafter described. However, if there is no blow from the relief valve with the dash-pot piston clear back (simple position), you may rest assured the reducing sleeve is not at fault. In this case remove the intercepting valve casing and ascertain if steam passes freely from live steam port when throttle is opened. If no obstruction is found there (and there seldom is), you may safely conclude there is an obstruction in the live steam way of the intercepting valve casing. In some cases, this steam way has been found entirely closed, while in others only a very



CONGO RAILROAD TERMINUS AT MATADI.

small orifice was discovered. This stricture (which is the result of core slipping) is found about on line with joint between cylinder saddle and intercepting valve casing, hence cannot be seen, neither can it be reached with fingers of the average man. One with small hand, however, can easily locate the stricture by removing the reducing sleeve and inserting the fingers in the steam way. Such a stricture may be removed by tapping through the wall of steam way at rear, after which the hole tapped may be plugged, thus saving the casting.

Another port which is sometimes overlooked is the emergency exhaust port for the high pressure cylinder. This port or chamber which takes in both the emergency exhaust valve and large gravity relief valve must necessarily be of considerable area, hence, a chamber 3 ins. through, 10 ins. wide and at least 14 ins. high surrounds both valves. At the bottom of this chamber, directly in line with the 4-in. opening for large relief valve, is 4-in. square port extending ahead 12 ins. at which point it joins the 8x6-in. main exhaust port.

Within this small 4-in. port, especially just at point where it enters the main exhaust port, may be found the cause of some engines having such a terrific blow exhaust when working simple. The cause of this is the moving of core resulting in a bad stricture within the small port. In fact, some engines have been found which could not be converted from compound to simple on account of the choked condition of this port.

Under the foregoing conditions it is plain to be seen why the emergency exhaust port should receive careful attention before the cylinders are bolted together, as at that time any obstruction can be easily removed. However, when engines are provided with the large gravity relief valve, same may be removed, which gives ample opening to facilitate the removal of any obstruction which may be found in the emergency port.

(*To be continued.*)

He bade me act a manly part, though
I had ne'er a farthing,
For without an honest manly heart,
No man is worth regarding.

—*Burns.*

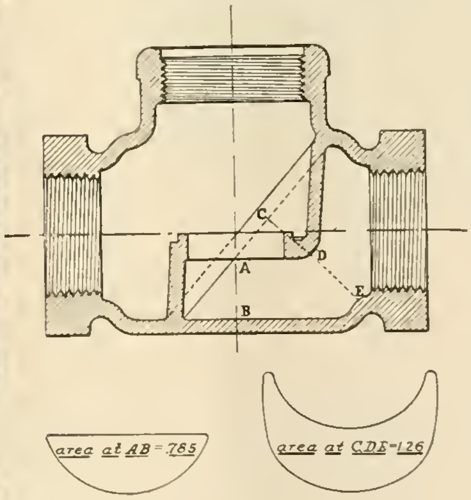
Some Features of the Hancock Valves.

The Hancock Globe valves, cross valves and Angle 60° valves are made of a special composition which is intended to give strength to the valve and insure resistance to wear, which latter means something. They are made, screwed and flanged up to the 3-in. size. These valves are made standard, for all pressures. Under actual test the bodies of these valves stand a pressure of 4,000 lbs. per sq. in. without breaking and are tight with a water pressure of more than 1,000 lbs. per sq. in. The company guarantees that each Globe, Angle 60° and Cross Valve has been tested with 1,000 lbs. water pressure and has been found tight at that pressure before leaving the works, and in addition these valves are guaranteed for 500 lbs. steam pressure.

In order that the valve seat may be durable, the body is made of a specially hard and tough mixture. The disks are made of a special mixture which does not contain any zinc. The spindles are all made of Tobin bronze. Experience has proved that a Tobin bronze spindle working in a special composition bonnet will not cut with the highest steam pressures.

These valves have been designed so that the metal is distributed to give uniform strength throughout and the areas have not been reduced or contracted for the purpose of reducing the weight. An interesting feature is the way the valve is guided on the stem. An inspection of our sectional illustration shows two collars upon the stem and these collars guide the disk nut, thereby compelling the disk always to seat squarely.

The flat form of seat has many advan-

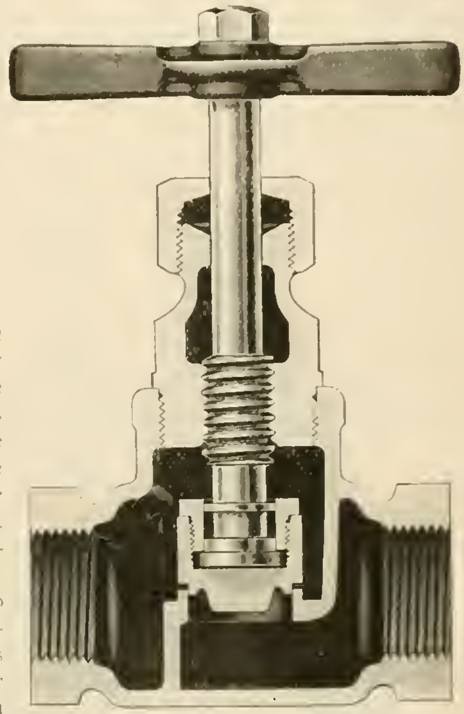


SECTION OF BODY, HANCOCK VALVES.

tages. The valve disk has a projection on it which serves two purposes. In the first place it acts as a guide when the seat has to be ground. In the second place this lip or projection on the disk prevents the cutting of the seat by the wire-drawing of the steam when the valve is "cracked" or slightly open.

Again when the valve is slightly raised from its seat as shown in the illustration with the lip just entered, it compels the escaping steam to clean the seat, so that when the valve is seated all dirt and foreign matter has been washed or blown completely off the seat.

The bonnet of these valves is made with a long thread engaging with the



SECTION OF HANCOCK VALVE.

body of the valve, and the shoulder on the bonnet is made quite narrow. By means of this narrow seat on the shoulder, it is possible to keep the bonnet tight, and when it is desired to, unscrewing the bonnet can be easily done.

When it is necessary to regrind the valve to its seat, the bonnet is removed, the disk nut unscrewed from the disk and a piece of wood may be inserted in the disk, enabling it to be ground perfectly, as the projection on the disk guides it, as it is not necessary to have any special regrinding tools for the purpose.

The tee handle on the Hancock valves has proved to be very satisfactory for opening and closing that it has become popular among the users of these valves.

The method of attaching the tee handle is that the hole in the handle is made taper with one side flat and the spindle of the valve is also made taper with one side flat to suit the handle, the tee handle being held firmly on the spindle by means of a nut. The flattened side holds the handle rigidly in place, and the taper enables the handle to be drawn tightly to the spindle, thus avoiding the annoyance of loose handles.

These valves are made by the Hancock Inspirator Company, whose general office and salesroom is at 85-7-89 Liberty street, New York, with a western branch office and salesroom at 22-24-26 South

Canal street, Chicago, Ill. The factory is at Boston, Mass. This company will be glad to give further information concerning these valves to anyone who will write to them and ask for it. The design has been well worked out and the whole idea is worth while investigating by those who "want to know."

Jokers Oppose Improving Urban Transit in New York.

It is really very amusing to read of the ridicule habitually cast upon every proposed enterprise for improving the transportation facilities in and around New York City. The first omnibuses used were the subject of continual pleasantry, and when the street cars first began to run the class of people who had always had a buggy of their own found the horse cars the finest object of merriment. The first elevated railroad was almost laughed out of business, and all sorts of silly jokes were leveled at the subway.

That tendency extended a long way back, for we read that when Chancellor Livingston first applied to the legislature of New York for a charter to navigate by means of steam he stated that "the wags and the lawyers were generally opposed to it and I had to encounter all their jokes and the whole of their logic."

Driver Brake Shoe Test.

As I am thoroughly convinced that nearly every railroad man in this and other countries reads Railway and Locomotive Engineering I wish to ask you to spare space in your next issue for the following account of a test which I made on driver brake shoes manufactured by the American Brake Company, the number of the shoes being G-612. I got 6,500 miles of local work out of them on the Fitchburg Division of the Boston & Maine. This division has some very heavy grades, and the engine on which I made the test does a large amount of switching. I wish to ask through the columns of Railway and Locomotive Engineering if my test is a good enough one. I expect to see something in the January number of the B. of L. F. magazine about this test.

Samuel N. Stevens,
A. B. Inspector.
B. & M. Eng. House, Fitchburg, Mass.

Useful uses of gasoline is the title of a catalogue we have just received from the Otto Gas Engine Works, of Chicago. The pamphlet shows some of the various applications of the gas engine to railway work. The first illustration shows it operating a sand blast. In the next, it runs an air compressor for a pneumatic tool car for field work. Again it moves a railroad swing bridge and when applied to a turn-table swings it round with ease. Write to the company for the catalogue if you are interested. It is called bulletin No. 1, and is well printed and illustrated.

Thermit—What It Is, What It Does.

The Thermit heating and welding compound is coming to the front as a ready and practical method of effecting economy in various ways in shop practice. One great saving brought about by its use is in the repairing of broken locomotive frames, which can be done without removing the wheels or other parts, as the welding is done with everything in place. The welded spot is as strong as the original piece itself, and in cases where the reinforcement or so-called "collar" can be left around the weld, it is really stronger than the original piece. The heat of the applied Thermit melts the broken ends, fusing them with itself; Thermit supplies the missing metal, the weld taking as large a reinforcement as the mold is made to permit. Broken cog teeth can be recast on a wheel with Thermit steel; cracked driving wheels can be neatly mended in place and an infinite number of useful and economical repairs made, that will keep down the scrap pile. Its use will give large resultant economy in time, patience and money.

Thermit itself is only a mixture of granulated aluminum and iron oxide, the combustion, or reaction, being started by means of an ignition powder. Thermit itself can be thrown into the fire without igniting, as nothing less than the heat of liquid steel will cause it to burn. As the combustion of the aluminum is supported entirely by the oxygen of the oxide, the reaction is entirely local, being confined to the crucible, there being no explosion or any gas resulting. The reaction is complete in a few seconds and the molten metal is instantly ready to run into the mold about the broken part; the iron, separated out from the oxide, makes a very good mild steel with only 0.1 carbon.

Thermit is now being manufactured in this country under the Dr. Hans Goldschmidt patents. The apparatus necessary for operations with Thermit is simple and inexpensive, and the process can be employed by any practical mechanic. Information can be obtained from the Goldschmidt Thermit Company, 43 Exchange Place, New York City, the home office in the United States, or from the Commonwealth Steel Company, of St. Louis, which has the agency for a large number of the most important western railroads.

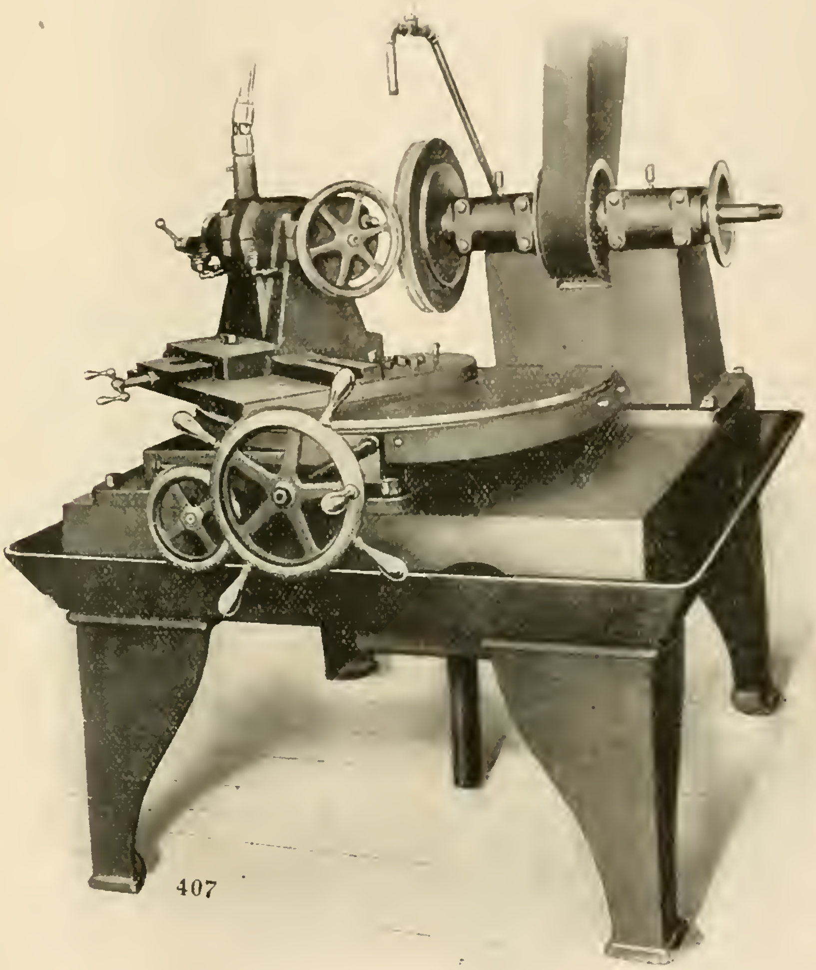
There is scarcely anything which is more entirely a habit than working power.—*Earl of Derby.*

Hand Wheel Grinding Machine.

The object of this machine is to finish the rim of the hand wheel from the rough at one operation, ready for the buffer, without machining it with a tool. The bed consists of a planed casting 3 ft. 7 ins. by 3 ft. 5 ins., mounted upon a cast iron pan on legs.

On the bed plate at the back is fixed the grinder-head. In front is a dovetailed slide, having 17½ ins. of bearing for the swivel-slide. This swivel-slide has a cross-feed to and from the grinder head of 13 ins. Upon this swivel-slide is mounted a second slide with its center fixed upon the swivel-slide in line with the grinding wheel so as to center all diameters.

A rotary movement is provided for the second slide by the pilot wheel shown in front. A cross adjustment is also provided for the head block carrying the hand wheel to be ground and the spindle holding the hand wheel is also adjustable so as to bring different diameters of hand wheels directly over the swivel center. The speed of the hand wheel to be ground is controlled through a universal joint driven from a variable speed counter shaft. On certain hand wheels the time was reduced from one hour to nine minutes. The makers of this machine are the Lodge & Shipley Machine Tool Company, of Cincinnati, O.



LODGE & SHIPLEY SPECIAL GRINDING MACHINE.

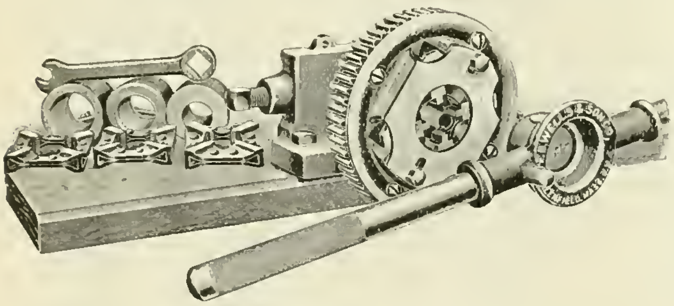
Rockefeller's Gift to Chicago.

Chicago has never been far behind in educational facilities and the city and the West generally are now about to secure the advantages of a first-class engineering college similar to Stevens Institute of Technology and other eastern seats of engineering learning. John D. Rockefeller, the Standard Oil magnate, has consented to donate $240,000 to the University of Chicago for the purpose of establishing an engineering department similar to Sibley College connected with Cornell University. Mr. Rockefeller has been a good friend of higher practical education, and his latest act of benevolence is we believe calculated to do more good than any of his previous efforts to help mankind. It has become the business of certain whelpish publications to bark at the heels of Mr. Rockefeller and other Standard Oil officials, but malice cannot take away the effect of the good deeds these men have quietly performed, and misrepresentation cannot rob people of the benefits conferred.

Wells Pipe Threading Machine.

F. E. Wells & Son Company, of 38 Riddle street, Greenfield, Mass., are putting on the market a new pipe threading machine for threading 1 in. to 2 in. pipe, as shown in our engraving. It is a very simple, compact little machine weighing about 45 lbs., which is used much like a hand die stock, only having gears to multiply the power so that one man can alone easily thread pipe that usually takes two, with a hand stock.

The die is held in the large gear, which has a threaded shank that screws into the main frame and acts as a lead screw to start dies. The pipe is centered by means of bushings the same as in an ordinary die stock, and is held from turning by two vise jaws on the back of the machine operated by set screws. The gears are all machine cut and all castings are of malleable iron to save weight and give ample strength even for the hardest usage. It can be bolted to either a bench or post and the vise, which is a part of the machine, can be used in place of an ordinary pipe vise. The "Economy" dies made by F. E. Wells & Son Company, are furnished with the machine, but any standard solid square pipe die will fit.



WELLS PIPE-THREADING MACHINE.

The moderate weight and small amount of work on it permits its being sold at a low price. For handles for operating or revolving die, one of the regular No. 1 Wells' stocks can be readily detached from the small gear shaft and used as a hand die stock for all sizes up to and including 1 inch.

The company will be pleased to give any further information about this interesting machine to those who will write to them for it.

A Boston Franklin Institute.

We do not know of any single institution organized to help the industrial classes to an education calculated to give them scientific knowledge of their business, which is doing so much good as the Cooper Union, of New York. It now appears that Boston and New England is to enjoy the benefits of an institution similar to the Cooper Union.

Benjamin Franklin in his will left to the city of Boston the sum of $5,000, which was to be invested and kept intact for a century, at the end of which time it was to be used for the benefit of the apprentices of the city. The board of selectmen and the ministers of three denominations were mentioned as the trustees, on whom the expenditure of this fund should fall. The money was invested in real estate shortly after the death of Franklin, and it was found upon the termination of the trust that the fund had increased to $270,000.

The announcement is now made that Dr. Andrew Carnegie has agreed to add $500,000 to Franklin's legacy. The city council of Boston will have the management of the new institution.

Baked Potatoes, Railroad Style.

A recent press dispatch from up-State gave an account of how some excellent baked potatoes came to be done to a turn, while in transit in a box car belonging to one of our leading railways. It is customary at this season of year, when shipping potatoes, to put a small stove in the car containing them and to bring its smoke pipe out of the space made when one of the doors is left slightly ajar. This space is covered with a board fastened on over the opening and below the smoke pipe.

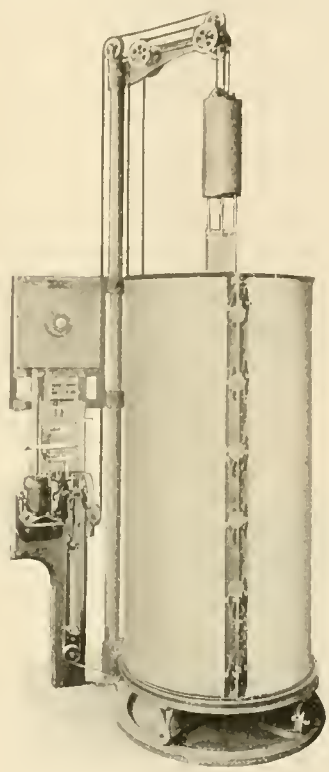
For some reason or other the legs of this particular stove were not put on when it was set up in the box car. Perhaps the stove had been through the wars and had lost its legs or perhaps some one thought that when the car was switched it might be thrown off its legs and it would be more solid without them. Whatever reason was when this stove was set up, the bottom rested upon the floor of the car and eventually the stove got the car "good and hot" and flames broke out.

A local fire brigade responded and the potato car was the center of much activity for about an hour, while the legless stove kept them busy. At the end of that time it was found that the stove had been able to bake from fifty to a hundred bushels of potatoes, while perhaps two hundred bushels of healthy but badly seared potatoes were taken from the car, which was itself damaged.

—Moral: Don't set up a stove in a box car so that it can bake anything in transit; it's not good practice and it may be illegal.

Blue Printing Without the Sun.

The art of making blue prints without the aid of the sum is explained in a very neat little pamphlet which has been got out by the Pittsburgh Blue Print Company. The principle of the thing is that two curved semi-cylindrical glass plates separated along their edges by strips of wood are rigidly bound together by top and bottom brass bands. A convenient canvas curtain is secured around the outside and the whole stands upon what may be called a turn-table base. The operation consists of placing the tracing next to the curved glass plate, the sensitized paper behind the tracing and all held in place by drawing tight the canvas curtain. A counterweighted electric arc lamp is then allowed to descend into the center of the glass cylinder and an auto-stop mechanism brings it to rest and starts it up and out of the cylinder. The machine is economical of space and the operation is economical of time. This is necessarily only a very brief outline of how the machine does the work. Write to the company if you want more details and fuller descriptions of the whole ingenious apparatus.



APPARATUS FOR MAKING BLUE PRINTS.

Preservative Paint.

Preservative paint for iron and other metals is not new, it having been made by a well-known paint concern 18 years ago. Elasticity or flexibility, if one may so speak of paint, is the feature which the Standard Paint Company, of New York, claims for their product. The liquid is free running and it develops a rubber-like quality, which enables it to stretch and shrink with the expansion and contraction of the metal to which it has been applied. The paint so to speak, "bites" into the metal and, as it were, becomes part of it. The company is willing to send test samples to prove the assertions they make.

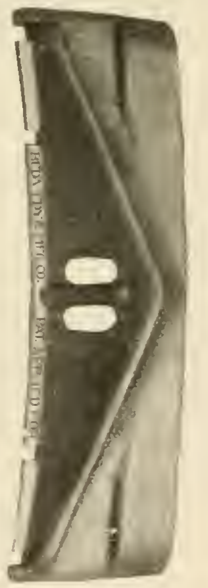
The Buda Car and Engine Replacer.

We illustrate herewith the new car and engine replacer or wrecking frog, now made and sold by the Buda Foundry & Mfg. Co., of Chicago.

The replacer is made of cast steel and and of a design calculated to handle the heaviest equipment without damage to replacer, and, what is more important, handle it promptly and without damage to equipment.

An important advantage of this replacer is that it provides for carrying the wheel on the tread and guiding by the flange at the critical time of starting a replacement. This avoids a very common danger of broken flanges where the weight of the equipment rests solely on the point of flange.

It is positive and gradual in its action



INSIDE BUDA REPLACER.

OUTSIDE BUDA REPLACER

and cars will not run over it but must travel to the track.

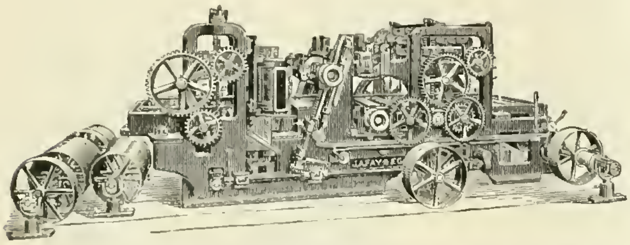
A complete bulletin on this interesting device is issued by the Buda Foundry & Mfg. Co., Chicago, Illinois, and will be sent on application.

"The man who pretends to be better than his fellow man is a canting rascal. The general average of men and women is more good than bad by a long shot. The man who sets himself up as all good is generally pretty bad."

No. 111 New Patent Double Cylinder Timber Dresser.

We present to our readers the picture of a new and improved machine for large lumber mills, car shops and shops where large timbers are worked, and where a powerful machine with a roll feed able to plane and joint dimension timbers on four sides at once is required. The machine is for every variety of heavy planing. It is able to meet these requirements exactly, and is the most powerful timber dresser built. It was patented December 19, 1899; March 20, 1900, and February 16, 1904.

The machine is solidly constructed to prevent vibration when working to its full capacity. It will plane timbers on two or four sides to 30 ins. wide and 20 ins. thick, or two sides and one edge of two timbers each 13 ins. wide and 20 ins. thick. The feeding mechanism is one of the finest and most improved ever placed on a tool of this description. It consists of six rolls, the two in front being divided and center geared, insuring a very powerful drive, and allowing two pieces of uneven thickness to be planed at once. The rolls easily raise and lower: all upper rolls are driven down, to insure a powerful drive, and the feeding out one is geared on both ends. The lower feeding-in rolls are mounted on inclines and can be lowered one inch below line of bed for dividing an extra heavy cut between top and bottom heads.



No. 111. NEW PATENT DOUBLE CYLINDER TIMBER DRESSER.

The lower cylinder is placed between the top cylinder and feed rolls, and has an independent vertical adjustment, draws out for sharpening or changing knives, and is belted from the feeding-out end. The pressure over the lower cylinder is four large rolls, each having an independent lift. The upper cylinder is raised and lowered by hand or power. Hoisting mechanism operates from the feeding-in end, and all parts are arranged to operate together. The upper cylinder and feeding-out rolls can be disconnected and parts raised by hand. Feed is controlled from the side or front, and has either tight and loose pulleys, cone or clutch. Feed-in platen removes to give access to inside of machine. This machine is made a size smaller, to plane 20 ins. wide or 30 ins. wide by 16 ins. thick, and is then called No. 125.

Further details can be had on sending postal card to the makers, J. A. Fay & Egan Co., of No. 445 W. Front street, Cincinnati, Ohio.

Also ask for their new illustrated catalogue of woodworking machinery.

An Interesting Catalogue.

"Pumping Machinery" is the title of a 132-page catalogue issued by Henry R. Worthington, of 114 Liberty street, New York City. The book is printed in two colors, the cover is lined and no expense has been spared to make it a most handsome machinery catalogue. The half-tone cuts, printed in black upon a high grade of coated book paper, stand out effectively from the reading matter printed in sepia. The cover is printed in black, light green and gold upon a dark green background, the whole forming an excellent example of the engraver's and printer's arts.

The apparatus described comprises the many types of pumping, condensing and measuring devices developed by this company in the 64 years of their existence, the most prominent being the Duplex Steam Pump, of which Henry R. Worthington was the inventor. Special designs of this type of pump are adapted to boiler-feeding, mine-pumping, removing air and circulating water for condensers, water-works, service, fire service, etc. This company has already made patterns for over six hundred different types of centrifugal pumps. One of the illustrations shows the large turbine pumps supplying the Cascades at St. Louis. This book should be in the library of every engineer and manufacturer.

An extensive line of air compressors and vacuum pumps is described in a 48-page pamphlet, 6x9 ins., just issued by the Clayton Air Compressor Works, of 114 Liberty street, New York City. More than twenty-one types of machines are shown in the illustrations including single and duplex machines, steam-driven, power-driven and electrically-driven by gear, chain and belt. The last page also shows air compressors driven by direct-connected oil engines, forming small convenient units which may be installed almost anywhere and which are said to be used extensively in quarries, stone shops, small machine shops and all small plants where air is used for general purposes, such as cleaning, etc. Other pages describe the air lift, the uses of compressed air in car barns, vacuum machines for experimental work, etc. The range of sizes includes machines displacing from two cubic feet of free air per minute to those having a capacity of 1,400 cubic feet.

Improved Pond Car Wheel Lathe.

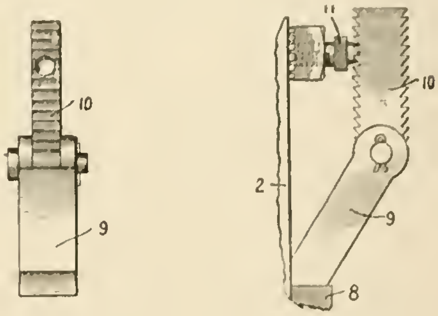
The lathe here illustrated is fitted with a new special equipment which makes it possible for it to turn out 36 pairs of car wheels per week. Such a lathe is set level with the floor so that wheels can be easily rolled in.

In placing a pair of wheels in the lathe bushings are put on the journals and the tailstocks are brought up. Then follows the adjustment of the "sure grip" driver, to which a large amount of the efficiency of the machine is due. The chuck jaws in the face plates hold the tires rigidly, and by screwing up the set screws of the sure grip the tires are firmly wedged between the driving plates and the chuck jaws so that the full power of this lathe may be employed.

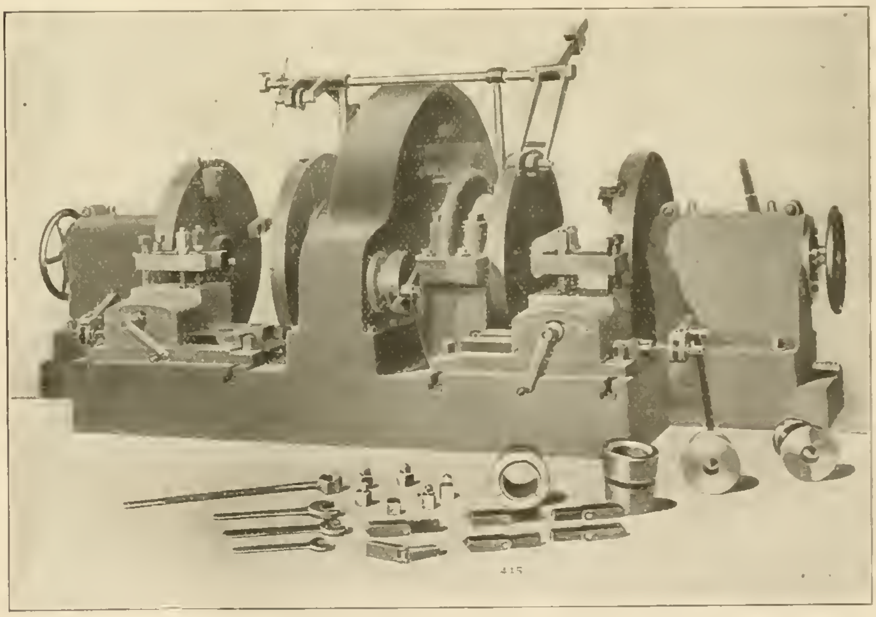
The sure grip mechanism is a very ingenious device. It ensures a positive drive and is simple and easily released. The tightening up of set screw 11, as shown in our line engraving, forces the teeth of the grip, 10, into the side of the tire, the supporting bracket, 8, is securely bolted to the driver plate and the action of the lathe in turning the wheel against a heavy tool-cut has a constant tendency to intensify the sure grip which the tightening of the set screw brought into play.

Self-hardening steel tools, 3x1¼ ins., in. steel, with narrow and blunt cutting edges and a 5 lb. hammer to be used in taking out hard spots.

It has been found that the greatest amount of work can be got out of the lathe when heavy feed and maximum depth of cut are employed rather than when high speed is used. Lathes of this description in the hands of an experienced operator may be expected to give an output of from five to seven wheels in ten hours. The Niles-Bement-Pond Co. of New York are the makers of this tool.



"SURE GRIP" FOR CAR WHEEL LATHE.



IMPROVED HEAVY POND CAR WHEEL LATHE.

are used. This size is sufficient to prevent springing and insures a steady, even cut. A tool such as this also quickly carries away the heat generated in continuously taking off the heavy chip. The makers recommend that each of these lathes be provided with at least six right and six left-hand roughing tools to allow for dressing, grinding, etc. Also two right and two left-hand tools of each kind used on flanges, two sets of scraper blades and 24 cold chisels, made of 1¼

The calendar published by the *Automobile Magazine* is a great success and the editor of that publication has been deluged with orders for it. The calendar is printed in three colors and represents an automobile stopped after a hard run near a rustic rill. A handsome young woman occupies the rear seat and is looking back approvingly at a young man who is filling a drinking cup at the rustic rill aforesaid. The details of the picture have been most tastefully worked out and altogether it is a work of art. Anyone wishing to have a pretty calendar can get it by sending ten cents in coin or stamps to Mr. Frank A. Egan, 136 Liberty street, New York.

Explosion in a Fire Box.

We have received the following letter which describes an explosion that puzzles us considerably. We subjoin our explanation, which is not entirely satisfactory to ourselves. If any of our readers have a more rational explanation to offer we should like to give our readers the benefit of their ideas. The letter reads:

"We have a peculiar case here on which we should like to have your opinion. There has been several theories advanced here, but there are several points in the case that seem to explode them. Engine 945 on passenger train was standing at station, when an explosion occurred in the firebox, blowing almost all of the fire out through the grates and fire door. Engine had 175 pounds of steam at time of explosion, and when smoke and steam cleared away in cab, engine had only 50 pounds. There was no damage done to engine and another fire was built and engine proceeded on trip and has been in service ever since. The last fire was put in about one and a half miles from where explosion occurred, blower was working enough to take up smoke, fire door closed, fire was rather heavy, but not covered with green coal. Engine has a self-cleaning front end, and was not choked with cinders. Engine not equipped with arch pipes, flues were not leaking, result of the explosion was blower broken off in front end, fire blown out of firebox, fire door blown open. The force of the explosion was down and to the left side of engine. Now the question is: what caused the explosion and what caused this loss of 135 pounds steam pressure, when there was no leakage in boiler or firebox, and engine did not lose any water? and time was not over three minutes."

[Our theory is that an accumulation of carbon monoxide gas (CO) formed in the upper part of the firebox and became mixed with the quantity of oxygen necessary to produce an explosion gas, which exploded through contact with the fire. The shock which drove the fire through the grates broke the blower in the smoke box. The explosion would induce a rush of cold air into the firebox and through the tubes which might account for the steam going down so suddenly.—Ed.]

Electrical Generators Driven by Gas Engines.

The California Gas & Electric Corporation, San Francisco, Cal., has just placed an order with Crocker-Wheeler Company, Ampere, N. J., for three 4,000 kw. capacity, revolving field alternating current generators to be driven by 5,400 h.p. gas engines built by the Snow Pump Co. These generators are the largest in capacity in the world, driven by gas engines, and will furnish power for operating all the street railways in San Francisco and vicinity.

This important sale by a company, which has been building alternating current machinery for so short a time, is a cause for congratulation. It is due in part to the fact, as announced several months ago, that the Crocker-Wheeler Company is the American licensees of Brown, Boveri & Cie, the celebrated Swiss electrical engineers.

Very few deadhead passengers have enjoyed the privilege of riding on the Twentieth Century Limited of the New York Central & Lake Shore lines, but passes used to be issued to a select few. A new rule for the New Year requires that every one riding on that train must pay cash. It is difficult finding through trains on these lines nowadays, that carry common passholders.

The Commercial Acetylene Company's storage system has been installed on a number of railroads. The quality of this light is such that it more nearly resembles sunlight than any artificial illuminant that we know. The gas is carried in a tank under the car and it is piped to the burners in the usual way. There are two sizes of storage tanks used, the larger one is 20¼x124 ins. This will hold 3,500 cu. ft., and the smaller size 16x102 ins. will hold 1,900 cu. ft. of acetylene. The complete equipment for a car is one tank, one pressure reducing valve, one pressure gauge and one filter, all of which are under the car. A very remarkable instance is given in the company's catalogue of a C. R. I. & P. chair car lighted with acetylene, which was in one of the many trains shut out of Kansas City for about ten days during the floods which took place there in the summer of 1903. This car was lighted all the time of its detention while candles and lanterns had to be used in other cars in the same train. Among the number of roads using acetylene may be mentioned the Great Northern of Canada, the Delaware, Lackawanna & Western, the El Paso & Southwestern, the New York, New Haven & Hartford and the Central South African Railways. Many others have partial installations.

The secretary of the American Railway Master Mechanics' Association has succeeded in obtaining from railway companies sufficient money to defray the expenses of the first series of tests of locomotive draft appliances. Professor Goss, who is supervising the tests, will now push the work as rapidly as possible, so that a report of the progress made may be ready for the next Master Mechanics' convention.

Two Educations.

"Every person has two educations," said Gibbon; "one which he receives from others, and one, more important, which he receives for himself." Of the two kinds of education to which the noted historian referred, the one given by a man to himself is the more important because he has the translating of his own experience and other people's ideas into the language of his own daily life and actions. There are, however, the two educations, and one of them, the one you receive from others, must come very largely from the books you read, because you cannot in the natural course of events, meet with as many people in your life as are capable of instructing you. You very greatly enlarge your acquaintance if you read the writings of others. You get close to those who are far away and you draw upon the experience of those who have lived before your time. All these people, those you know personally and those you know through the medium of the printed page, all help to give you one of your educations, then you must, yourself, see to the value of the second. We present for your consideration a list of helps in the education which you must get from others.

The first on the list is, of course, Railway and Locomotive Engineering, a practical journal of railway motive power and rolling stock. It costs only \$2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and children see it.

"Twentieth Century Locomotives," Angus Sinclair Co., deals comprehensively with the design, construction, repairing and operating of locomotives and railway machinery. First principles are explained. Steam and motive power is dealt with; workshop operations described, valve motion, care and management of locomotive boilers, operating locomotives, road repairs to engines, blows, pounds in simple and compound engines; how to calculate power, train resistance, resistances on grades, etc. Shop tools explained. Shop receipts, definitions of technical terms, tables, etc. Descriptions and dimensions of the various types of standard locomotives. The book is well and clearly illustrated and is thoroughly up to date in all particulars, fully indexed. Just off the press. Price, \$3.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for \$2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. The price of it is 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. The price is 75 cents.

The 1904 Air Brake Catechism. Conger. Convenient size, 202 pages, well illustrated. Up to date information concerning the whole air brake problem, in question and answer form. Instructs on the operation of the Westinghouse and the New York Air Brakes, and has a list of examination questions for enginemen and trainmen. Bound only in cloth. Price, \$1.00.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, breakdowns and repairs. Convenient pocket size, bound in leather, \$1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, \$1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion, it is easily understood by every intelligent fireman. The price is 50 cents.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable, and, best of all, they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Standard Train Rules." This is the code of train rules prepared by the American Railway Association for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotive, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

An Inside-Connected Locomotive for Purdue University.

Negotiations have been completed whereby Purdue University is to receive from the New York, New Haven & Hartford Railroad, through the courtesy of Mr. Samuel Higgins, general manager, the historic locomotive "Daniel Nason." A few years ago the University interested itself in securing from railways, samples of such classes of locomotives as are now being superseded by machines of more modern construction, its purpose being to preserve as museum exhibits types of design which were in danger of becoming extinct. As a result of this plan, a number of valuable relics are already upon its grounds. From the beginning of this movement, an effort has been made to secure a representative of a type which was common throughout New England thirty years ago, namely, an eight-wheeled engine having cylinders inside the frames connecting with the crank axle. This effort has now been crowned with success. The "Daniel Nason" is said to have been built in 1858. It was exhibited in Chicago in 1893 and has since been held as a relic at Roxbury, Mass. The engine weighs about twenty-five tons, is complete with its tender and will be shipped to the University at Lafayette, Indiana, upon its own wheels.

The University is also to become the custodian, on behalf of the same railway, for a stage-coach passenger car which is said to have been placed in service in 1835. It consists of the body of a stage-coach suspended over a simple railway truck by means of thorough-braces. It will seat inside and on its top about twenty persons.

Facts About Panama.

I notice on page No. 542 of your December number a communication from K. Y. Z., which gives a very wrong idea of the conditions at Panama—from which place I have just returned. There are occasional cases of yellow fever brought there from other parts of South America, but during the last five years, during which I have known about the health of the Isthmus, there has been no epidemic of any kind, except an unusual prevalence of small pox due to neglect of vaccination among the poor. There are malarial diseases, as in all tropical countries, but those who live prudently do not suffer more than in many parts of the United States. The Canal Commission has already accomplished excellent results in sanitation, and has a large force engaged in that work.

As to wages, the accuracy of your correspondent's statements may be judged from this table of wages, paid by the Panama R. R. Co. in U. S. Gold:

Locomotive engineers, per month	$157.50
Blacksmiths, machinists, etc., per day	4.50

Of course it is best for men to secure certainty of employment before going to the Isthmus, as the supply has been, so far, quite equal to the demand.

CHARLES PAINE,
General Manager, Panama Railroad.

Of all the catalogues of tap and die makers, which come to our office, perhaps the illustrated catalogue of the J. M. Carter Tap and Die Company, of Pawtucket, R. I., is the most easily singled out. To begin with the catalogue has a good index at the beginning and the next few following pages illustrate and describe the various forms of screw threads, which are used. These are the V thread, United States Standard, Whitworth (English), the Carriage bolt thread, the 29° Acme standard and the International and French (metric) thread. Then comes a complete illustrated array of all the various taps and hobs made by this concern. After which are the dies, die holders, stocks, etc., and the sets of taps and dies put up in hardwood cases. There is a very great variety to choose from and the information given concerning each is complete. The firm will be happy to send this catalogue to those who are interested enough to write to them for a copy.

Latest New Year's Style in Smoke-stacks.

The engine here illustrated is a real steam machine of iron and steel and does its day's work like everything else on a railroad. If you were so much as to say "freak" to this little engine it would snort with indignation, because the beautiful curve of its smoke stack and the down draught pipe to the front footplate do not form a disguised attempt to make the engine consume its own smoke nor burn its own cinders over again. The exhaust steam and the products of combustion strike the center of the track every time.

Some people thought that an ingenious idea had been worked out whereby the engine was compelled to drop its cinders along the right of way as it went along, and so became a sort of self-ballaster, but this is not the case, and as it is a hard coal burner, it does not have many smoke box cinders to give away.

The truth is, this engine was once a gay little puffer on the Manhattan Elevated in New York and used to run along on the structure, looking in at second-story windows, but now it has got down to cellar level in the Subway and its smoke stack has a crook in it like front end of a trombone.

CURIOUS EFFECT OF ELECTRIC SUBWAY ON STEAM LOCOMOTIVES IN NEW YORK.

"Circumstances alter cases," and this engine proves the rule. A steam locomotive is very useful now and then even on an electrically operated tunnel railway. This engine has had its smoke stack altered so that when it works in the New York Subway its steam and smoke or soot-laden water will not be driven against the white tunnel roof. The little engine is occasionally allowed in, but it must not disfigure the walls or ceiling of the tunnel, and, generally speaking, must be on its good behavior, though it does occasionally snort and spit at the third rail with its return flue smoke stack, but that is perhaps natural in a steam engine and may be forgiven.

When running forward this engine can do what few other locomotives can do—it can run over its own smoke. When it is drawing a couple of flat cars behind it, loaded with construction material, there is a little whiff of steam seen continually coming out from under the last car, just like the way you see it from the last Pullman on the "limited," and it almost looks as if those old construction flat cars were actually steam heated by the little engine with the trombone smoke stack.

Making a tool for one's own use, trying and testing it in one's own shop, and improving it up to the selling point—that is the way the Becker-Brainard Milling Machine Company, of Hyde Park, Mass., evolved their Cutter and Reamer Grinder. This machine is designed to sharpen milling cutters of all kinds and shapes. It is heavy enough to do away with all vibration, and it does not require special fixtures and special shapes of emery wheels. The left side of the machine is used for grinding the periphery of cutters. Those with holes are slid on a bar and those on shanks are carried on centers and fed with the table. The right side is used for grinding end, side and angle cutters. A neat little circular has been issued by the Becker-Brainard Company, describing these machines and they would be very happy to send a copy or give other information to anyone interested enough to write to them on the subject.

The most seasonable appliance this winter in the Northern States is the Priest locomotive flange. Many trains that have lagged hours behind time would have been punctual had the flanges been at work giving the leading wheels an unobstructed path.

Don't talk about it, try it.—*John Hunter.*

The Southern Railway has issued a many colored poster 2 ft. by 2 ft. 9 ins. showing the "Palm Limited" flying along amid the infinite variety of tropical foliage and flowers with which Florida is always associated. Through the fronds of a spreading palm can be seen one of the magnificent hotels belonging to the Florida East Coast Hotel System, and amid the rigors of our northern winter we can only envy the happy couple on the rear platform of the Pullman on their way to rest and enjoyment in the sunny South.

International Railway Congress.

The committee on the District of Columbia to whom was referred the House Joint Resolution granting the temporary occupancy of a part of the government reservation in Washington, D. C., for the American Railway Appliance Exhibition, reported in favor of passing the resolution and the exhibition will therefore be held on this most desirable piece of ground.

The International Railway Congress will meet in the United States for the first time in May, 1905, in the city of Washington, D. C. This distinguished body is composed of the high officials of railways throughout the world. An invitation for its meeting in this country was extended by the late President McKinley, through Secretary of State Hay, in 1900, and at the last session of the Federal Congress an appropriation was made to defray the expenses of representatives thereto of the United States Government. It is estimated that upward of 500 foreign railway officials will be in attendance upon this meeting.

The interesting thing about a Homestead straightway blow-off cock is the fact that when it is closed the plug is forced firmly to its seat. This is done by what is called a traveling cam on the top of the plug. Balancing parts are cut in the plugs, which allow steam pressure to predominate on the greater area of the top of the plug, and this holds it gently in its seat when open. Homestead valves are made in many forms, such as three-way, four-way, stop cock, angle valves, etc. Write to the Homestead Valve Manufacturing Company, of Pittsburgh, for catalogue if you would like to see how the plug is operated and held without leak in the open and closed positions.

Unjust Private Cars.

We have frequently commented upon the drainage on railroad revenues made by private car lines. Here are a few lines on the subject taken from the report of the Interstate Commerce Commission. Also seasonable remarks on other railroad matters:

The terminal railroad owned or controlled by shippers is a dangerous means of giving preference to favored persons.

The operation of private car lines is attended by many evil practices.

Twenty-three per cent. of all the fatalities of the year on the railroads resulted from ten accidents. The total number of accidents was 10,800.

Many who are opposing legislation giving the commission more power in the matter of maintaining rates persistently misrepresent the position of the commission.

Laxity of discipline, long hours of labor, employment of inexperienced men, overtaxing facilities for handling business and the influence of labor unions are among the causes for the large number of accidents.

J. A. Fay & Egan Co., of Cincinnati, Ohio, have been awarded a medal at the St. Louis World's Fair, on the fine operation of one of their tools. The firm had no regular exhibit, but some of its tools were shown and operated by other concerns, while exhibiting their various products, to do which required some wood-working tools. It proves high quality to win a medal on a tool operated by others.

The full line of Barrett Track and Car jacks, and about forty sizes of Barrett jacks, for all lifting purposes, were exhibited in both Transportation and Machinery buildings, at the St. Louis Exposition, and the Duff Manufacturing Company, of Pittsburgh, Pa., who are the makers of these jacks, received a gold medal, which is the highest award in its class, on the assortment of jacks, which embraces many sizes, adapted to all classes of work, and which also included the Barrett Motor Armature Lift, the Barrett Pipe Forcing Jack, the Barrett Automobile Jack, and the Differential Screw Jacks. The highest award was given for Barrett Jacks.

The Pressed Steel Car Company has opened an office in the South and Mr. L. O. Cameron has been appointed general sales agent, Southern District, with headquarters at Atlanta. Mr. Cameron will have charge of all matters pertaining to the sales department in connection with railroads and manufacturing concerns located in the southern territory.

The Westinghouse Electric & Manufacturing Company, through their agents, Messrs. G. & O. Braniff & Company, of Mexico, has been awarded the contract for all the electrical apparatus to be installed at the El Oro Mining and Railway Company, El Oro, Mexico. This contract amounts to nearly $100,000.

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Railway and Locomotive Engineering

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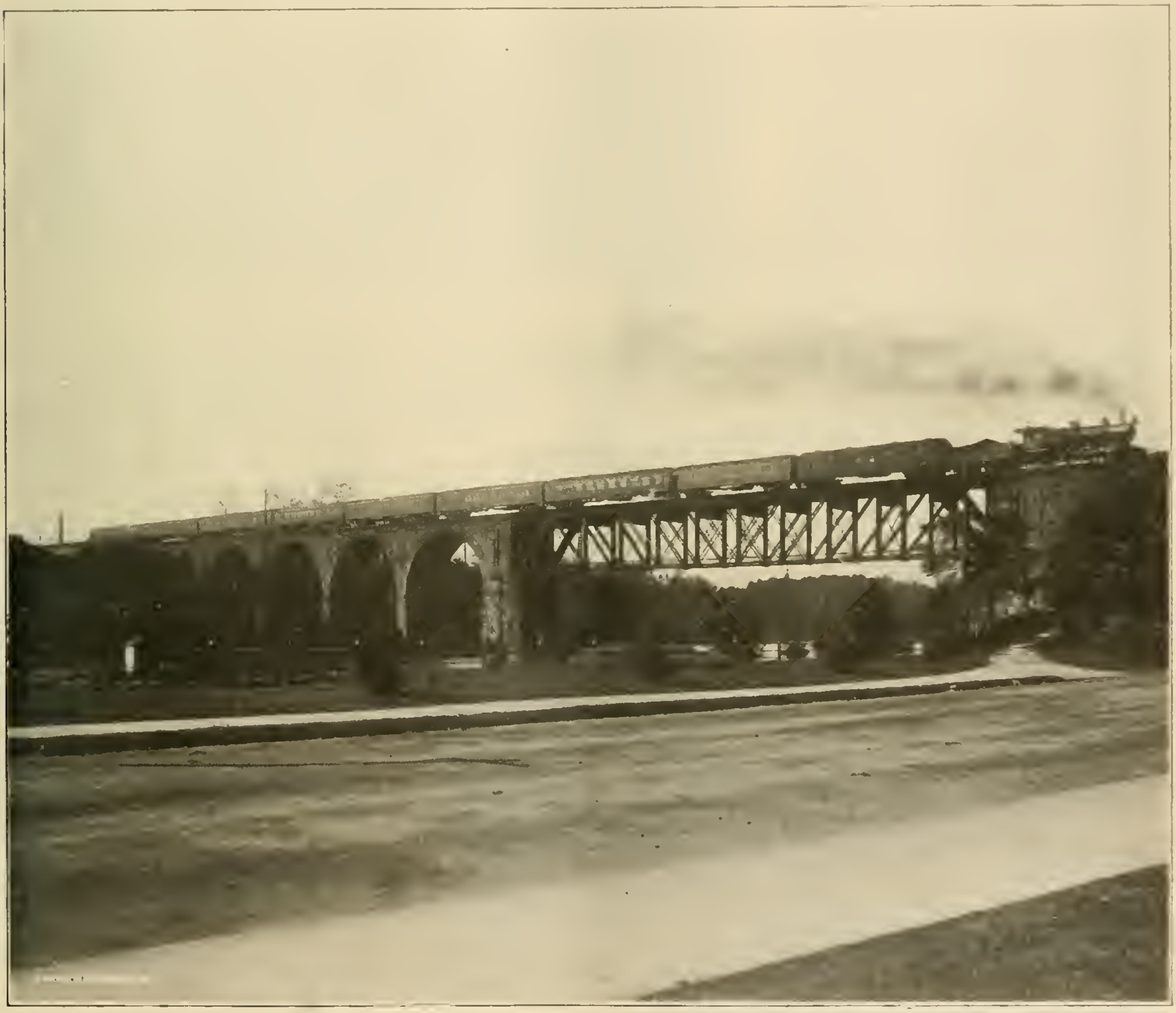
Cars and Carriages.

On the American continent a railway train is composed of various kinds of cars, day, Pullman, chair and a great variety of freight vehicles, but all called cars. In Europe and other parts of the world they have carriages and coaches for passengers and wagons for freight. Our word car comes from shortening the word carriage. Besides the car there are the names coach, chariot, cart and a great variety of foreign words used to denote a wheeled vehicle.

Tracing the growth of the car is an interesting study. Those who have enjoyed the privilege of examining Egyptian and Assyrian slab sculptures would notice that the war chariot was used in those early periods of the world's history. It is likely that the war chariot was a development of the humble charette, still to be seen in Mexico, in Central Africa, in India and in other eastern countries that have been little influenced by progressive tendencies.



PENNSYLVANIA RAILROAD TRAIN CROSSING FAIRMOUNT PARK BRIDGE, PHILADELPHIA

For long centuries the car remained a two wheeled vehicle, the four wheeled carriage being a comparatively recent invention. It may have been that the funeral procession for Jacob that went out of the land of Egypt contained four wheeled vehicles, but history gives no information to this effect, as sculpture down even to Roman times tells nothing about the development of the car represented by the addition of another pair of wheels. This was strange, for we are told that Solomon maintained a force of 1,400 chariots, so car building must have been a familiar art in Egypt, which was the principal seat of that ancient industry.

When Rome became rich and luxurious the riding on a rough two wheeled chariot must have been regarded as too strenuous a pleasure, for four wheeled vehicles then came into use and riding in them constituted one of the expensive luxuries that Romans were so prone to enjoy. The makers had not, however, advanced to the extent of using steel springs or even leather hangers, so the luxury of carriage riding over rough roads must have had modification.

The dreary times that followed the decline of the Roman Empire saw no improvement made on wheeled vehicles. For several centuries nothing is said in history about wheeled carriages, and almost the first renaissance of the carriage was in 1475, when Frederic III attended the council of Frankfort in a magnificently decorated covered carriage. For a few centuries afterwards it was the property only of kings, queens and princes, and from them it gradually extended to rich people of every degree.

When tramways were first introduced into Great Britain for the transportation of coal and other heavy goods, the four wheeled truck came into use, and it has gradually expanded into the 50-ton box car, the Pullman sleeper and the president's palace on wheels.

Tunnel, Ditch or Flume?

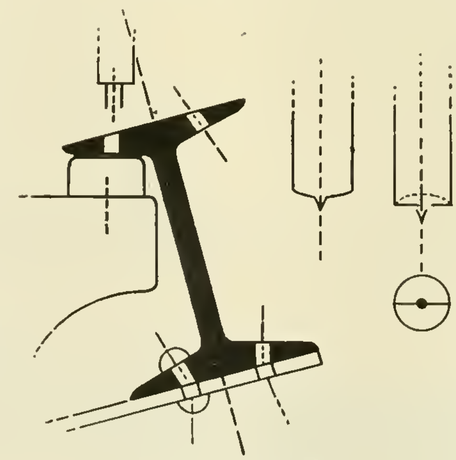
The Canadian Pacific Railway have some plans under consideration for getting water for their locomotives, and any one of them will involve a considerable outlay of money. On the Pacific division of that road there is a long stretch of territory where, at certain periods of the year, water of any kind is hard to get.

Last summer, in British Columbia, water had to be hauled from Greenwood and Eholt, because the usual sources of supply failed. The proposition is to tap Bear or Loon lake at what is called Summit Camp, two or three miles from the point where the water is to be used, which is Eholt. A tunnel for the water, if driven straight through, would cost about $15,000. Another plan is to dig a ditch and so bring the water down, or to construct a flume. Either of these plans would require something over three miles of ditch or flume and would introduce a maintenance charge, such a charge would probably be next to nothing with a well constructed but more expensive tunnel.

Punching Structural Steel for Tenders.

Tender frames are almost universally made of structural steel shapes, channels and I-beams being most commonly used. The punching of these rolled shapes is done in various ways in the different shops throughout the country.

In many shops the effort has been made to do the punching so that the axis of the holes shall be parallel to the web of the rolled sections, and of course all will be parallel to each. As everybody knows, the inside of the flanges in structural steel are at an angle to the flat level, outside of the flange. When holes are punched with axis parallel to the web, there is generally a bevel-faced die put on the lower jaw of the punch to accommodate the sloping underside of the flange. In addition to this the bottom edge of the I-beam, etc., has generally to be held in toward or against the machine, as the downward stroke of the punch has a tendency to cause the work to slip off on the bevel die and so necessitate its being brought back into line again. This method of punching keeps the rivets quite straight when other members are joined to the steel shape.



PUNCHING I-BEAMS

In one of our leading railway shops we recently came across a method of working by which the punching was done without reference to the parallel idea as far as the axes of the holes were concerned. In this case the bevel side of the flange is laid flat on the die and the descending punch encounters the upper surface of the flange at an angle. This method of punching causes the holes to be as they appear in the illustration. A reamer, when run through before rivets are applied, somewhat modifies the angle at which the hole is punched, but the rivets when driven are not straight; the important point, however, is that the holes of the I-beam and the plate are absolutely in register, and as the rivet is made to fill both holes, and as there is no vestige of a shoulder at the point of union, the bending of the axis of the rivet is not thought important. In fact, a certain advantage is claimed for it, and that is that the bent rivet lessens the strain on the rivet heads, and the punching can be done without any specially constructed supports or apparatus for holding the steel I-beam or channel in place. A shearing punch is not necessary, but the face of the punch should be flat or slightly hollow, and not rounded.

Signals and Signaling.

BY GEORGE SHERWOOD HODGINS.

THE STAFF SYSTEM ON THE QUEEN & CRESCENT ROUTE.

The electric train staff system has not been generally adopted or used to any extent except on some four or five roads in the United States; notably among these roads is the Queen & Crescent Route.

The staff or tablet system originated in England, and is extensively used in that country on single track roads. The Webb & Thompson machine was the first type to be used in this country, and the Queen & Crescent was among the first roads to put these machines in service. Within the last four years a new type of staff machine called the High Speed Staff Instrument, designed and patented by Mr. T. H. Patenall, of the Union Switch & Signal Company, is in use on the Cincinnati, New Orleans & Texas Pacific Railway, commonly called the Queen & Crescent. The object of this design of machine was to reduce the size and weight of the staff, so that ways and means could be provided for delivering the staff to trains running at high rates of speed, which was quite impracticable with the original design of staff. The Queen & Crescent Route was the first road to install and operate this high speed instrument.

A necessary adjunct for the successful operation of the staff system under the most advantageous conditions is the control of the switches at the ends of the block by interlocking mechanism, as this keeps traffic in motion and trains leaving the staff-block limits can be quickly turned into diverging routes, if necessary, at the ends of staff blocks. This condition exists when a train of inferior class is using the staff blocks on close time, with an opposing train of superior class waiting to proceed.

In our illustration, Fig. 1, the case hanging from the crane with a cross at the bottom is the rubber tube containing the staff. The line illustration, Fig. 2, shows the method by which the staff case is locked in the catcher, when picked up so as to prevent it from falling out. This is accomplished by a small pivoted trigger with teeth on it, upon which a dog, in the form of a ratchet works, and having caught, it holds. The catcher itself does not shut automatically towards the gangway, but is drawn in by hand after the case is picked up, and the case is then taken from the delivering arm by the fireman under the supervision of the engineer, the engineer being held responsible for this by the company's rules.

FIG. 1. TRAIN STAFF IN RUBBER CASE READY TO BE PICKED UP BY ONCOMING TRAIN—C., N. O. & T. P.

In the view shown in Fig. 1, where the train is in distance, one of the signals is shown at "proceed" and the other at "stop." The signal in the proceed position is the interlocking signal, and the signal in the stop position is the train order signal, or in this case the staff signal, and it is not thrown to the proceed position until the engineer is enabled to have a clear view of the staff signal. The rules on the Cincinnati, New Orleans & Texas Pacific require all train order signals and automatic signals to move in sight of the enginemen of an approaching train; the interlocking signals are the only signals that these rules do not require to be seen by enginemen to actually move. This is why the illustration, taken from real life, shows this signal up; the operator, having set the main line route and the signals of the interlocking system, is seen to be waiting, before dropping the train order signal or the staff signal, until the train approaches closer. These interlocking and train order signals are of the normal stop, system and the automatic signals are normal proceed, or clear.

THE STAFF SYSTEM AS IN OPERATION OVER THE RATON MOUNTAIN, ON THE A., T. & S. F. RAILWAY.

The train staff system, as used on the Atchison, Topeka & Santa Fe, is an electrical device for handling trains on a single track without time card or train orders. The responsibility for the proper handling of the train rests with the engineer on the head engine. This system was inaugurated on the Raton mountain between Raton, N. M., and Trinidad, Colorado, in 1901, and has been in successful operation ever since. The description which follows was furnished by the signal department of the A., T. & S. F.

The system uses an absolute and a permissive staff, the absolute staff being distinguished from the permissive staff by the handle being milled, while the handle of the permissive staff is fluted. The absolute staff is used for trains descending the grade. The permissive system uses the permissive staff and six tickets. These are used for trains ascending grade; seven trains can thus be run through the same block at the same time, the six leading trains would each be given a ticket, and the last train would be given the permissive staff with the fluted handle.

The stations are blocks, each about four miles apart, each intermediate station having two staff machines, one for each direction. These stations are connected by telegraph and telephones. There is a system of signals handled from each block station to indicate whether trains are to come up the main line expecting to find a staff ready, or to head in on a siding to meet an opposing train.

The staff machines are arranged so that an equal number of staffs must be used in the machine of each block, and when one staff is taken out another cannot be taken from either machine until this staff is replaced in the machine it was taken out of, or put into the machine at the opposite end of the block.

The permissive staff is used in a manner similar to the absolute staff. When a ticket is taken out with the permissive staff, an absolute staff cannot be taken out of either machine until all the tickets and the permissive staff are replaced in one of the machines at either end of the block. There is, however, only one permissive staff and six tickets for each block. As the permissive staff and tickets are always sent up the hill, the permissive staff and all the tickets are returned by the first train coming

C., N. O. & T. P. TRAIN IN THE ACT OF CATCHING STAFF.

down, and they are considered as equal to an absolute staff.

Each station is provided with a crane, and the staff or ticket is deposited in a rubber pouch, which is placed on the crane ready for the approaching train

The enginemen on the head engine throw off the pouch containing the staff, which they had been using, and catch the staff from the crane at the station which they are passing; the engineer immediately examines the staff, and, if he finds it is a staff with a milled handle, he knows he has an absolute staff and that no train can be in the block ahead or following him, until he reaches the next station. If he finds he has received a permissive ticket, he expects to find a train ahead or following, or both. When he finds the permissive staff in the pouch, he knows there must be a train in the block ahead, but there cannot be any following, as the last section is always given the permissive staff together with all the tickets which have not been used and sent ahead on other trains.

A staff "maintainer" is stationed midway on the part of road over which the staff system is operated. His duties are to keep the lamps and signals in proper condition, and in the event of so much train movement business taking place in one direction, as would cause an accumulation of train staffs at either end of the block, he can unlock the staff machine, take out a number of staffs and put them in the machine at the other end of the block; by doing so he evens up the staffs at each end. This, however, does not often occur. There are 36 staffs in each block, and as many as 36 trains can be moved in one direction, taking all staffs from one machine, before it will be necessary to send any staffs back to the delivering station.

Each station is provided with interlocking signals, and these are operated from the staff office. Suppose a train was approaching Lynn from the west, finding the semaphore with both arms horizontal, the crew would understand that they were to head in on the passing track; if the lower arm, which is green, was horizontal and the red arm above was down, the crew would understand that the train was to come up the main line, but could not get a staff on account of a west-bound train occupying the next block. If the block east of Lynn was clear, the operator at Lynn with the assistance of the operator at Wootton would get a staff, and place it in the interlocking plant which would allow him to drop the green arm, and the east-bound train crew would understand that the staff was ready and in the crane.

When a train enters the block, the operator makes the fact known to the operator at the other end of the block, by a system of electric signals given by ringing a bell; besides this he reports the train in the usual manner on the train wire, so that the dispatcher also has a record of it. By way of illustration, suppose Lynn rings that an east-bound train is in the block, the operator at the next station east, which is Wootton, would ring for a staff in the block east of him and would be given a staff by operator at Morley, who would simply have to touch a button in the staff machine to do so; this would allow the operator at Wootton to remove a staff, provided there was no other staff out of either machine. Otherwise, it would be impossible for him to get a staff, and the train would have to wait until the block was clear and a staff replaced in the machine.

When an engineer receives an absolute staff, he knows positively that there cannot be another train in the block, and no train leaving the opposing station can get a staff until he has arrived and delivered his staff.

Trains can be handled with the staff system with as little, if not less delay, than with any other system. This was shown by Mr. C. W. Clark's special, January 27, 1904, which was handled from Winslow to Chicago, and broke all previous records over the Raton mountain, where the staff system is in use.

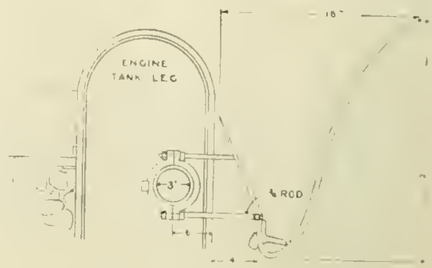


FIG. 2. STAFF CATCHER ON TENDER—C., N. O. & T. P.

STAFF CATCHING APPARATUS ON ENGINE—C., N. O. & T. P.

As to the volume of business which the staff system is capable of handling, the following table of trains handled for a period of ten days on this section of the A., T. & S. F. is instructive:

EAST BOUND.

Passenger.....	30 trains.	238 cars.	
Freight	64 trains.	1,222 loads.	594 Mts.
Engines, light 283			

WEST BOUND.

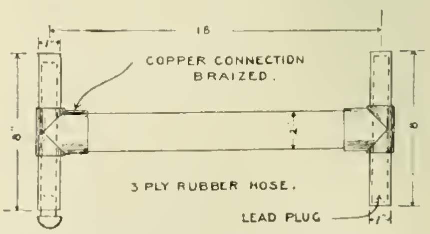
Passenger.....	30 trains.	252 cars.	
Freight........	92 trains.	2,502 loads.	60 Mts.
Engines, light 195			

Total trains 694. Average trains per day 69.4.

The movement of trains by the staff system is, on this road, controlled by the dispatcher, he instructs the operators when to put trains in the side tracks to meet trains, or to let trains pass, going in the same direction. The dispatcher has to watch the trains closely to see that freight trains do not interfere and cause delays to passenger trains, but the safe movement of all trains is positively assured.

Unusual Hue for the Iron Horse.

The Atlantic & Birmingham are painting their passenger engines red. The tenders are also red and so are the coaches, and altogether the entire train is striking in appearance. Some years ago a writer in one of the English magazines referred to some engines of that color on one of the well-



TRAIN STAFF CASE MADE OF RUBBER HOSE—C., N. O. & T. P.

known railways of Great Britain as the "Red Racers of the Midland."

The innovation on this side of the Atlantic may give an opportunity to some newspaper writer who always refers to a fire as a "conflagration," to call these trains the "Ruby Rushers of the A. & B." We incline to think, however, that such things as first cost, durability and the advertising advantages of the color, will be very closely studied in this country before the somber iron horse of to-day puts on war paint as a regular thing.

THE SMOKING ROOM IN THE COMPOSITE OBSERVATION CAR—C., M. & ST. P.

A Composite Observation Car.

What may be called a new departure in the way of design and internal arrangement of a passenger car, has been inaugurated by the Chicago, Milwaukee & St. Paul Railway, in some new equipment recently purchased from the Barney & Smith Car Company, of Dayton, Ohio.

The cars are called composite observation cars, and the idea is to have the smoking compartment placed in a convenient position somewhere near the center of the car, thus leaving clear the rear portion which is really the observation end. This arrangement has been made so that the observation room and platform may be used by ladies and gentlemen.

In both the observation room and smoking rooms, writing desks have been provided, and in the observation room there are book shelves and stands on which the current periodicals are to be found. In the forward end of the café and smoking compartment is a lounge above which is a magnificent mirror surrounded with a frame of the new Tiffany illuminated glass, which makes one of the most pleasing effects that has ever been produced in car construction.

The lighting arrangement is so arranged that every passenger in the car is provided with ample light for reading. The smoking rooms are supplied with specially designed exhaust ventilators, which rapidly carry away the smoke.

The carpets have been woven according to special designs which are in strict conformity with the ornamentation of the car. The upholstering in the observation room is frieze plush, and in the smoking room Spanish effects in leather have been used. All of the hardware, lamps, etc., were specially designed for these cars. The interior woodwork is St. Jago mahogany with inlaid marquetry designs of line and ornament. Many rare woods have been used, among them being Tulip, Amaranth, Saffron, Olive, Boxwood, Satinwood, English Oak, White Holly, Prima Vera and Cocobola. These rare woods have been inlaid in the figured mahogany, and form a beautiful example of costly and elegant internal car decoration.

The exteriors of these cars are painted with the standard color of the Chicago, Milwaukee & St. Paul road, and they present a most pleasing appearance. The art glass effect in the windows is very effective. Mr. F. A. Miller is the general passenger agent and the officials of the road are to be congratulated on the advent of the composite observation car in passenger service.

Winston Tunnel on the C. G. W.

What is known as the Winston tunnel on the Chicago Great Western Railway is situated 18 miles east of Dubuque, Iowa, and passes through the bluffs leading away from the Mississippi river. It measures 2,450 ft. long and the interior height from rail to dome is 18 ft. 6 ins. with a width of about 16 ft.

The tunnel was driven through solid rock and was finished by being walled up with brick backed by concrete. There is one air shaft situated about 800 ft. from the east end. It is 64 ft. deep and is 6 ft. in diameter. There is no artificial means of ventilation.

The coal used on the engines is full of sulphur, which gives off a suffocating gas. With trains of 960 tons or over a double-header is used. Westbound trains usually drift through, but the engines of eastbound trains have several fires put in while in the tunnel. The height of the stacks and the shape of the ceiling cause the gases from the locomotive to be driven down round engine and train.

In getting through it is the usual practice for the head brakeman to ride on the pilot where he encounters the purest air there is, but the engineer and fireman generally have to use waste saturated with water or a silk-covered wet sponge, which is held over the mouth and nose. This keeps out a great deal of gas, but the heat is intense.

In order to encourage the men to meet these conditions the company have appropriated $100 to defray the cost of experimenting with any device that has in it any promise of success. The object is to reduce the temperature in the immediate vicinity of the engineer and fireman and to keep the gas away from the men. The device may be an attachment to the stack or something to wear over the face or a means of discharging air from the main reservoir into the cab. There is a chance for some good thinking, and the C. G. W. stands ready to try the experiment for the comfort of the men and will pay the cost up to $100.

A Stop Signal Device.

The device here illustrated is the invention of Mr. Thomas Cairns, a locomotive engineer, who lives in Auckland, New Zealand, whose letter appears in our general correspondence colums. He says he was stimulated to get out this patent by studying the pages of RAILWAY AND LOCOMOTIVE ENGINEERING.

The apparatus is, briefly, an attachment to a regular semaphore signal. The arm, C, in the illustration, rises and falls as the semaphore blade, B, is raised and lowered. When in the stop position the arm C is horizontal, and is long enough to engage with the projecting handle of a stop cock on the train pipe, which in this case has been carried up through the roof of the cab. As signals are not always on the same side of the railway, and as a locomotive sometimes travels back along the same line of rails, the extension of the train line to the roof of the cab is fitted with a branch pipe and a stop cock is thus placed on each side of the cab.

In the event of a "run past," the handle of the stop cock J, on top of the cab, would be suddenly struck back by the projecting arm, C, the stop cock opened wide, and an emergency application of the brakes would instantly follow.

The idea here embodied in this patent is similar to the system which is used in the New York Subway and on the Boston Elevated. In the Subway the electrical current is cut off and the brakes are applied in the event of a "run past." On the Boston Elevated, under similar circumstances, the brake would simply be applied in the emergency. Both of these lines use a trip close to the track and do not have any overhead apparatus. Neither of these lines have any trouble with snow.

The Richmond Compound.

BY H. C. ETTINGER, AIR BRAKE INSTRUCTOR, WABASH RAILROAD.

(*Continued from page 38.*)

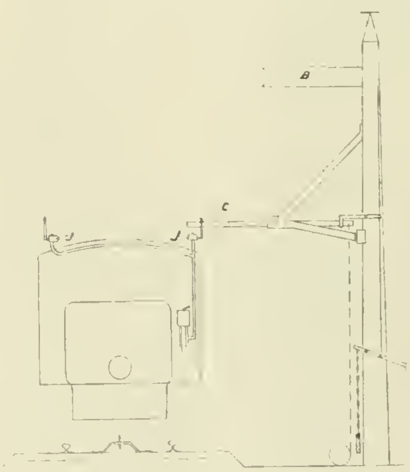
PORTS.

Other ports to be carefully looked after when applying new low pressure cylinder are those to and from the over-pass valve chamber. These ports being small, it is not uncommon to find them partly filled with metal, hence, care should be taken to clean them out well, more especially those leading into the steam ports. Otherwise air could not pass freely, thus defeating the purpose of the over-pass valves.

The ½-in. port in the dash-pot head meets all requirements, hence, should not be changed (by the introduction of pipe or cock), otherwise the accumulation of pressure ahead of dash-pot piston may foul the intercepting valve.

There is considerable difference of opinion as regards the proper size of port at rear of dash-pot, some claiming the 1/16-in. port should be maintained, thus eliminating the violent movement of valve, more especially after shoulder in worn dash pot prevents good fitting rings. Others having a great deal of experience firmly believe this vent port can be and has been made ⅛ in. with good results, owing to the larger port not being so easily stopped up. Besides, it relieves the leakage which otherwise may force the piston ahead, closing live steam port to low pressure chest the moment throttle is opened.

Having carefully noted the foregoing conditions on some eighty locomotives running from six months to six years, I believe vent port at rear of dash pot should be made ⅛ in., and when perceptible shoulder is found in dash pot, same should be bored out and fitted with new piston and rings.



AUTOMATIC STOP SIGNAL.

There are still other ports which must have careful attention. In this connection, do not overlook the ⅛-in. port located 1-15/16 ins. from rear of large end of reducing sleeve. This ⅛-in. hole in side of the reducing sleeve is to make it more sensitive to the variation of pressures, as it would hardly be reliable enough to depend on leakage to fill and vacate this space incident to the movement of the reducing sleeve. Furthermore, the absence of this port would make the functions of the reducing sleeve decidedly uncertain. In fact, were the sleeve a steam-tight joint on the valve stem, it would not act as a reducing valve at all, in which event excessive pressure entering the low pressure chest would continually raise the pop valve when starting or while working the engine simple

To prevent leakage past faulty packing rings (on sleeve or stem), forcing dash-pot piston ahead when throttle is open, care should be taken to ascertain that vent ports in reducing sleeve, intercepting valve stem and dash-pot head are of ample size and not obstructed.

In this connection, see that the ½-in. port in side of dash-pot head is in communication with port at side of valve stem. It must also be noted that cavity now cored in center of intercepting valve and stem is thoroughly cleaned out before plug is placed in rear end, otherwise foreign substance left in this cavity will find its way into the ⅜-in. port in rear end of stem, thus defeating the purpose of the vent port.

To eliminate the possible movement of the intercepting valve by the pulsation of the high pressure exhaust, see that the four ¾-in. holes are in rear end of the valve, and last, but not least, ascertain condition of the six live steam ports in the rear of the reducing sleeve chamber. In the first place, end ports should be ¾ in. wide, hence should be chipped and cleaned out to give full opening. In the second place, it should be remembered the rings in large end of reducing sleeve must pass these ports, which being about 2 ins. long afford a good chance for end of ring to spring out and catch edge of port, thus breaking the ring or fouling the valve. For the foregoing reasons care should be taken to round the edge of both sides of port, thus permitting ring to pass without catching.

Doubling the number of bridges and making same ⅜ in. instead of ¼ in. would still leave ample opening, besides eliminating the trouble of rings catching in long parts.

Cleaning out or blowing out ports will be dealt with under head of blowing out steam-ways, etc.

Ought to Be Chased.

"Poor steaming engines ought to be chased off every railroad running through trains," remarked the conductor of a train, the writer was trying to get home on, and the man of the punch looked significantly to the engine on the head end of the train. We had just started from a division point and the scribe had been watching the engine just before starting and noticed that the steam was low. As they pulled through the yard the fireman was throwing coal into the fire box, and then he began shaking the grate vigorously. Our impression was that engine and fireman both suffered during the trip, but it seemed that the hardships endured by both might have been mitigated by a little work before the start was made.

Narrow Gauge Tank Engine for Japan.

The engine here reproduced is a 0-6-2, and though it is not a Mikado type it is destined for the Mikado's dominions; in other words, this tank engine has been built for the Imperial Government Railways of Japan by the Baldwin Locomotive Works. The engine is of course simple, and has 16x24 in. cylinders, 49 in. driving wheels and runs on a track 3 ft. 6 in. gauge. The service to be performed in the land of the rising sun is "pulling passengers."

The main valves in this engine are the ordinary D-slide, they are under the smoke arch, and are made of bronze and are driven by direct motion valve gear. The main drivers are the middle pair and they have flat tires without flanges. All the driving springs are underhung but are not equalized together.

The boiler is 49 ins. diameter, and is of the flat top type made with two barrel courses. The fire box is made of copper and the tubes are brass. There are 192 of them and they are each 1¾ ins. in diameter and 10 ft. 5⅜ ins. long. The tubes are No. 12 B. W. G. at the fire box end and No. 14 gauge at the smoke box. The heating surface is 994.4 sq. ft. in all, of which the fire box contributes 93 and the tubes 901.4 sq. ft. Copper, bronze and steel stays are used, and there are through rods which unite the back sheet with the ronnd head or front flue sheet.

The engine has a compact appearance and the cab is roomy, considering the gauge of the road. Placed just behind the smokestack is a device for relieving back pressure in the dry pipe when the engine is drifting. The whistle, or rather the pair of them, is ingeniously fastened to the overhang of the steel cab, upon which it sits with a broad-based flange. A small pipe curves up from the auxiliary dome and passing in under the ledge of the cab roof supplies the whistle with steam. Old-fashioned spring and lever safety valves are mounted on the auxiliary dome casting.

The tank capacity is 1,811 U. S. gallons of water 1,000 of which are held in the side tanks and the rest at the back under the coal receptacle. The coal space is 75 cu. ft. in all and the floor of the coal box slopes forward toward the fireman.

Some of the principle dimentions are as follows:

Boiler—Thickness of sheets, ½ in.; working pressure, 160 lbs.

Firebox—Length, 74 15/16 ins.; width, 27 ins.; depth, front, 62¼ ins.; back, 45¼ ins.; thickness of sheets, sides, ½ in.; back, ½ in.; crown, ½ in.; tube, ½ in. and ⅞ in.; water space, front, 2½ ins.; sides, 2½ ins.; back, 2½ ins.

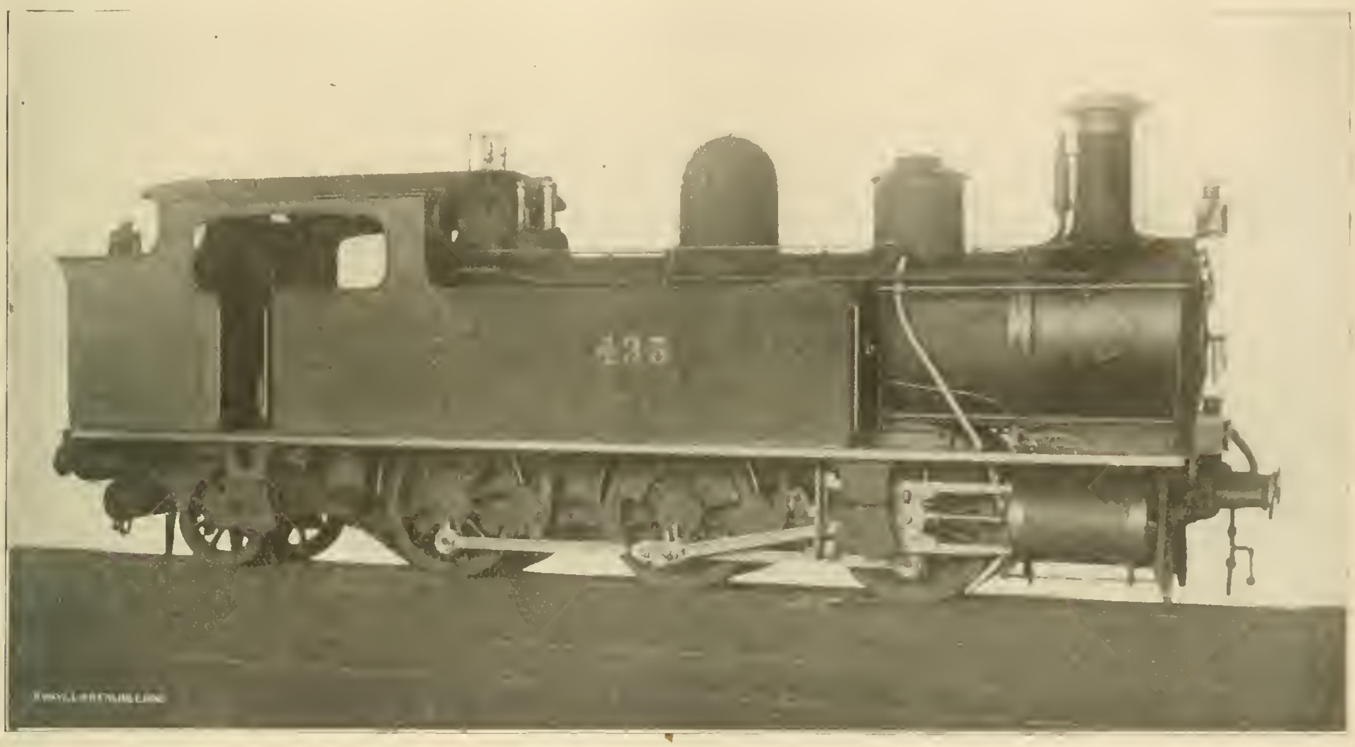
Grate Area—14.5 sq. ft.

Driving Wheels—Journals, 7x7½ ins.

Engine Truck Wheels (Back)—Diameter 38 ins.; journals, 5x8½ ins.

Wheel Base—Driving, 12ft. 6 ins.; total engine, 19 ft. 9 ins.

Weight—On driving wheels, 82,700 lbs.; on truck, back, 19,300 lbs.; total engine, 102,000 lbs.



Imperial Gov't Rys. of Japan. NARROW GAUGE TANK ENGINE FOR JAPAN. Baldwin Locomotive Works, Builders

The Sanitation of Passenger Cars.

Present day conditions in modern railroad sleeping cars have been made the subject of study in the laboratory of the Public Health and Marine Hospital Service, and the authorities consider the wash-bowl arrangements in cars and the open hopper closets to be very unsanitary.

The director of the laboratory, Surgeon-General Wyman, has pointed out the desirability of designing interiors with smooth, plain, hard, surfaces, which do not give permanent lodgment for dust and which can be easily cleaned. Plush, tapestries, drapery of all kinds should be banished from railway service as unnecessarily increasing the risk of harboring germs.

An improved method of handling sleeping car linen has also been suggested. As it is now, soiled sheets are rolled up and thrown into a locker and during the process they undergo more or less violent shaking. The proposed plan is to have a strong waterproof bag carried through the car by the porter and into this bag all soiled linen should be thrust with as little shaking or disturbance as possible. The bag then to be closed tightly with draw strings and put in a special locker until taken off at the terminal.

Woolen blankets are generally of dark color and do not show how much or little they need to see the inside of a wash tub, and as it is not customary to wash blankets very often under any circumstances, the railway variety are only washed at long intervals and get more and diverse use than blankets in an ordinary dwelling house. It has, therefore, been suggested that sleeping car blankets be provided with slip covers, easily removable and made of washable material. A slip cover removed every day and a fresh one applied, would keep a well washed and thoroughly disinfected blanket sweet and clean for a long time.

Pattern Handling System.

The system of handling patterns in the new establishment of the F. B. Sturtevant Company, of Hyde Park, Mass., is very interesting.

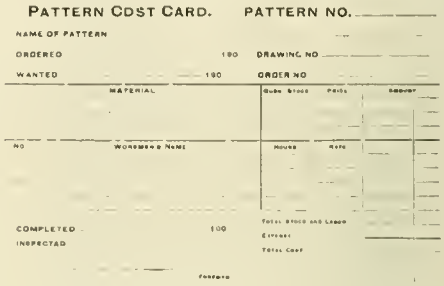
New patterns are numbered consecutively upon the drawings as made. Patterns for gray iron castings take a number without prefix. Patterns for brass castings take a number preceded by O, those for steel have the number preceded by OO, and so on, with a different prefix for each material. The numbers are taken out by the draughtsmen in a blotter having columns for date, pattern number, name of pattern and drawing number. This record is afterwood transcribed into the "Pattern Record" Book by the record clerk in the draughting room.

NEW PATTERN SHOP F. B. STURTEVANT & CO.

At the time of taking out a new pattern number a "Pattern Cost Card," form 462, is filled out. This is sent with the drawings to the foreman of the pattern shop and is an order for him to make the pattern described. The time is kept in the pattern shop and entered on this card as is also the record of stock used. When the pattern is completed, it is inspected by the pattern shop foreman, who signs cost card and enters date completed. The pattern is then sent at once to the pattern storage, which is under the supervision of the pattern foreman, and the pattern cost card is returned to the drawing room by the next messenger. The pattern cost card is figured by the record clerk in the drawing office and filed by pattern number, consecutively. The item "expense" is obtained by keeping a record of the total labor in the pattern shop and the total material purchased for the pattern shop. When any work other than pattern work is done a record is kept of the time and material and the pattern shop is given credit. These records give the amount of material and labor chargeable to expense, to which is added a depreciation and fixed charges. The whole is then distributed as a percentage on the hours of pattern labor.

When the patterns are delivered to the pattern storage department proper locations are assigned and records thereof made upon cards (form 383), one for each pattern. These cards are filed in the order of the pattern numbers. Four figures with the addition of a letter are in every case sufficient to locate a pattern. A given location, for instance, may be 2125 B; that is, it is upon the second floor, as shown by the first numeral "2;" it is in the twelfth row of shelves and the fifth division of that row as shown by the succeeding numbers "12" and "5;" and on the B level, the floor level being designated A, and the letters B, C, D, etc., indicating the shelves in their order above.

When the foundry foreman receives an order for castings from the office he issues to the pattern storage department a copy of form 407-B properly filled in. The pattern storage keeper on receipt of same refers to index of patterns (form 383), and finds thereon in the upper right-hand corner the location of pattern which he immediately records upon card 407-B. The latter he attaches to the pattern and delivers it to the foundry. A metal clip placed upon form 383 indicates that the pattern is out. When form 407-B is filled in at the foundry office a copy is sent to the clerk of the cleaning room, who daily records on the back the number of good and bad castings made from the pattern and keeps the moulder informed as to the number of castings required to complete the order. When the required number of castings are made, the pattern is returned to the pattern storage, and the metal clip taken off form 383. One copy of form 407-B is destroyed and the other is retained in the foundry office files.



PATTERN COST CARD. PATTERN NO.

NAME OF PATTERN

ORDERED 190 DRAWING NO

WANTED 190 ORDER NO

MATERIAL

NO WORKMAN'S NAME HOURS RATE

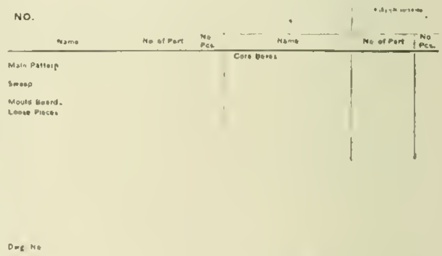
COMPLETED 190

INSPECTAD

STURTEVANT PATTERN FORM 462.

Great Western Railway Locomotive Testing Plant.

The practice which had its origin at Purdue University of testing locomotives



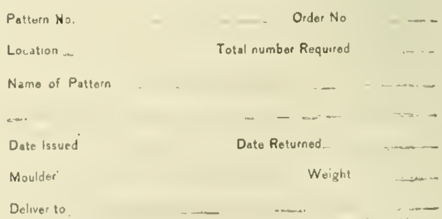
NO.

Name	No of Part	No Pcs.	Name	No of Part	No Pcs.
Main Pattern			Core Boxes		
Sweep					
Mould Board. Loose Pieces					

Dwg No

PATTERN FORM 383.

on stationary plants is growing into favor, and led to the magnificent locomotive testing plant installed by the Pennsylvania Railroad Company at the St. Louis Exhibition. Just how much information of a useful character will be obtained from testing plants is yet an open question, but we notice that several railways in foreign countries have provided themselves with locomotive testing plants, among them being the Great Western Railway of England. Mr. G. J. Churchward, locomotive



Pattern No. Order No

Location Total number Required

Name of Pattern

Date Issued Date Returned

Moulder Weight

Deliver to

PATTERN RECORD FORM 407B.

superintendent of that railway, contributed a paper to the American Society of Mechanical Engineers concerning the testing plant, of which the following are the principal parts:

1. This machine consists of a bed made

of cast iron, bolted on a concrete foundation, with timber baulks interposed for the lessening of vibration. On this bed five pairs of bearings are arranged to slide longitudinally so that they may be adjusted for any centers of wheels that are to be put upon the plant. In these bearings axles are carried having wheels fitted with steel tires, on which the locomotive runs. These axles are also fitted with drums on which band brakes act for absorbing wholly or in part the power developed by the engine. Outside these band brakes, pulleys having an 18 in. face are provided at each end of the axle for driving link belts, by which it is intended to transmit the major portion of the power developed by the engine to air compressors, so that it may not be wasted.

2. The hydraulic brakes will then only absorb just enough power to enable them to govern the speed of the engine. These provided with a rack, and each pair of bearings is provided with a cross shaft having a pinion at either end. These cross shafts are driven from a longitudinal shaft through suitable clutches. This longitudinal shaft is operated by electric motor and is capable of being reversed. The engine being run over the machine on an elevated frame which carries it on the flanges of its tires clear electrically and drops the engine into position on the carrying wheels with their bearings till they are vertically underneath the wheels of the engines to be tested. The frame is then lowered electrically and drops the engine into position on the carrying wheels.

4. When running engines on trial trips it is essential that the bogie and trailing wheels of engines so fitted should be run as well as the driving wheels, in order that the axle boxes may take a good bear- mounted on the same platform, for measuring the water used when running, these tanks being emptied alternately when consumption test is being made

6. Under the platform a dynamometer enables the drawbar pull of the engine to be taken, and this, together with counters on the wheels, will enable the actual drawbar horse power to be measured, and so compared with coal and water consumption for various classes of engines. As engines of different lengths are to be tested, and of necessity have to be fixed at the trailing end to the dynamometer, it is necessary to have a sliding chimney for carrying off the steam and smoke from the engine when running. This has been provided in the form of a long box, having a steel plate running on rollers forming its lower surface, which plate carries a large bell mouthed chimney. This box not only enables the

LLANDUDNO BAY, WALES, ON THE LONDON AND NORTH WESTERN RY.

brakes are actuated by a water supply from an independent pump, the outlet of this water supply being throttled either by a stop valve or by a throttle actuated by a centrifugal governor. This latter device enables the speed of the engine to be set at any required number of revolutions and kept constant.

3. The carrying wheels are 4 ft. 1½ ins. diameter. The main bearings are 14 ins. long by 9 ins. diameter. The tire of the carrying wheels is turned to approximately the same section on the tread as the rails in use on our line. This plant is intended not only for the purpose of scientific experiment, but also to do away with the trial trips of new and repaired engines on the main line. It has, therefore, been necessary to make it rapidly adjustable to take engines having wheels of different centers. The main bed is ing, and be seen to be in satisfactory condition before handing the engine over for traffic. To accomplish this the carrying wheels are all coupled together by a suitable arrangement of belts and jockey pulleys. It, therefore, follows that even when a locomotive having a single pair of driving wheels is run on the plant, all the carrying wheels are rotating and in turn run the bogie and trailing wheels of the locomotive. The jockey pulleys are necessary to retain the proper tension on the belts when the bearings are moved longitudinally.

5. Owing to the varying height of the footplates of different classes of engine, it has been found necessary to provide a firing stage which can be rapidly adjusted vertically. A large coal bunk is provided in connection with this stage and also weighing machines. Two water tanks are chimney to slide longitudinally, but will also form a receptacle for ashes and any other matter ejected by the engine, which will be retained and can be examined both for quantity and quality.

7. It is hoped that this plant will enable many questions of the relative economy of different classes of engines, either simple or compound, to be settled definitely. The question of superheating might be investigated on it, as also the efficiency of various forms of smoke box arrangements. The effect of various percentages of balancing can be investigated, and, in fact, any of the experiments which are at present being made on the road may be made on this plant, with the great advantage that any engine which may be selected can be placed in position ready for testing and all connections made in a time probably not exceeding an hour.

General Correspondence.

An Expert on Wear of Rails.

While preparing one of his historical articles on the "Growth of the Locomotive," the editor had occasion to consult Professor Dudley, M.E., Ph.D., of the New York Central, on the wear of rails. The following interesting letter was received too late to be used for the article which originated the information.

Editor:

The iron rails which were used at the inception of the railroads sustained the wheel loads until they were increased to 10,000 and 12,000 lbs. upon the drivers. Then when the speed of the express trains was from 25 to 30 miles, as per the schedules, the iron rails failed rapidly under the service. There is a strong probability that the driving wheels, with their iron tires, were quite irregular, and decided dynamic shocks produced in running. The heads of the rails did not fail so much from a gradual loss of metal, but by portions becoming detached from the surface and the side of the heads of the rails. The welds in the piles from which the rails were rolled were not perfect, and became loosened and detached in service. Some of the English rails, made out of refined iron, rendered 10 to 12 years' service, under wheel loads of about 8,000 lbs., but as soon as the wheel loads were increased to 10,000 and 12,000 lbs. under the drivers the rails failed rapidly, and it was impossible to keep the tracks smooth. The surface of the rails at first would be injured at the ends, then after the old rails were cut and repiled for rerolling, the rails failed from large portions being detached anywhere in the length of the rail.

The same conditions as to wear prevailed in England and on the Continent. The expensive rails made from the refined irons rendered excellent service under the light wheel loads. After the first iron sections of 56 to 60 lbs. had been used, stiffer sections, weighing 75 and 80 lbs., were designed. While the top slab of the pile was made from the refined iron, these stiffer rails as girders failed more rapidly than the lighter and more limber sections. Many of the English roads which adopted 85 and 95 lb. rails, were obliged to return to smaller sections. At that time it was not understood that as the stiffness of the rail as a girder was increased, that the intensity of the wheel pressures would be greater upon the bearing surface of the rail.

The tires made out of Low Moor iron did not wear round, and these under the high speed trains at that time were severe upon the rails.

Many of the most expert ironmasters in England came to the conclusion that it was impossible to make an iron rail which would long sustain the wheel loads of 10,000 and 12,000 lbs. You will note in reading of the maintenance of the railroads, upon iron rails, that the most distinguished engineers were in favor of reducing the loads upon the axles and the weights of the locomotives and cars.

The iron rails also broke as girders, as the stiffness was increased. This was due to slabs rolled out of the old rails which were high in phosphorus to make a hard wearing head, forming the base of the rail, and would not stand the shocks from the passing locomotives and cars.

When the light sections of steel rails supplanted the iron rails, the axle loads upon the driving wheels were about 12,000 lbs. The metal was sufficient to make a smooth running surface, and those light rails carried from sixty to ninety million tons, with a loss of about 1/8 inch from the head of the rails.

As soon as it was ascertained that the steel rails outlasted five or six of those of iron, the axle loads were slightly increased, and by 1875 and 1880 a few locomotives had axle loads of 13,600 lbs. The early steel rails failed in the track more as girders than from wear of the rails. It was impossible to make the tracks sufficiently smooth for high speed trains.

Upon the introduction of the 5 inch, 80 lb. rails, in a few years the axle loads were increased to 40,000 lbs. upon the drivers, for passenger service. The metal in the steel rails was sufficient to sustain the pressure between the wheel contacts and the surface of the rail. The wear, however, was slightly faster than in the smaller sections. Part of this was due to more rapid production in manufacture, and a lessening of the quality of the steel, but another feature was the increased stiffness of the rails, making a smoother running track for the driving wheels.

It is now well known that as we increase the stiffness of the rail as a girder, we should provide more bearing surface, or increase the physical properties of the steel, to sustain the increased wheel pressures.

Of recent years the axle loads have been increased under the driving wheels to 48,000 and 50,000 lbs. The cylinders have been increased, and with the larger boilers, the expended tractive effort is much greater, which also increases the stresses in the rails. This produces a more rapid wear upon the surface.

With the stiffer rails, which have been made out of higher grades of steel, that is, more carbon, the wear has not been so fast as it was in the lower sections. The condition of the track has been much smoother, permitting of high speed trains, with less destruction to the locomotive and the track, than was the case on the lighter rails.

The wear on the heavier and stiffer rails is fast, unless provision is made for a greater bearing surface, and higher physical properties in the steel. This follows a mechanical law, though it is but little known and understood.

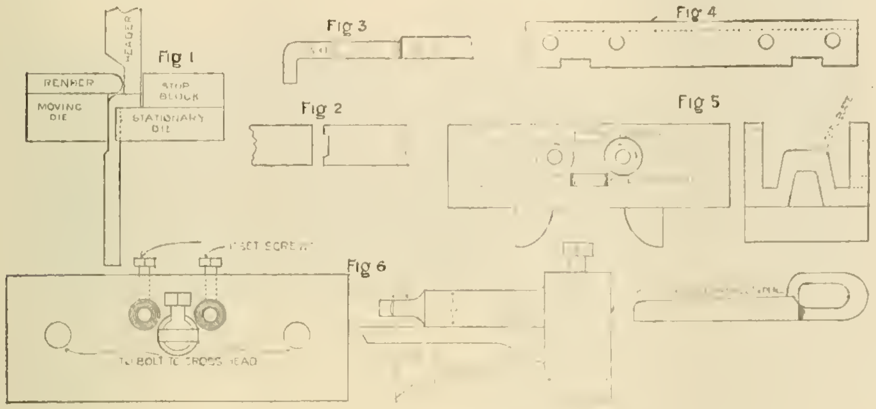
P. H. Dudley.

NEW YORK CENTRAL SNOW BLOCKADE FIGHTERS.
(Courtesy of Mr. O. W. Thompson, Division S. M. P., Oswego, N. Y.)

Visiting the Shop.

Editor:

Most of the railroad shops have an iron-clad V-welded rule not to allow visitors in working hours and our shop was no exception, but the rule was often broken for the special benefit and edification of the fair sex, who evinced a decided interest in watching the workmen at their allotted tasks and the operations of the different machines.



BLACKSMITH SHOP KINKS.

The comprehensive and original remarks of the fair sex concerning the aforesaid, was very amusing if not instructive.

It fell to my (shall I say fortunate?) lot to be the pilot of a party of five young ladies and while there was no bones broken or airship flights, we had quite an exciting time one afternoon.

There is an old saying that whenever there is trouble look for the woman in the case and remembering this saying, when the party of young ladies proposed to visit me at the shop I scented danger at once and made the excuse that no visitors were allowed, but this was knocked out by one of the young ladies, saying that she knew very well that Mary Ann Splivins and Polly Jane Catchem had been allowed to go through the shops, etc., etc. I thought I would head them off by telling them if they got a permit from the office I would do the rest with pleasure. When a woman will, she will, and this is how the memorable visit came to pass.

One day they made their appearance, escorted by the office boy as far as the blacksmith shop. Thinking the ladies would enjoy seeing the machines first, I took them to our bolt heading machine and as the operator was gibbing strap bolts on dies I had designed and perfected for the purpose, I naturally felt an excusable pride in the process, and proceeded to explain all about it to the girls.

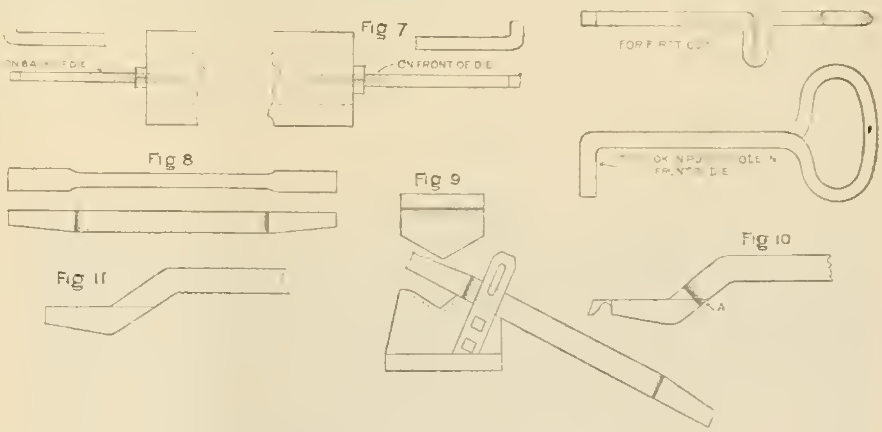
These dies are very handy in a shop with a bolt-header, so I give them in detail in Figs. 1, 2 and 3, for ½x1½ ins. strap bolts. Any other size can be made as well by a different stationary die The machine makes the pieces as rapidly as they can be heated and fed to it.

I had remarked that I was the inventor of this device to the ladies and one of them asked me what kind of a machine it was and I answered a bolt-header, and she took a kind of cursory glance around it and answered that it was a funny name for it as she did not see any boat for it to hold there. Another one wanted to know if that man jabbing the hot iron into the boat-holder didn't get awful tired making the machine go so fast and if he quit jabbing the iron at it, would it stop?

The sporty one of the party wanted to see if she could make a bolt and as this would add interest and stop hard questions I consented and volunteered to guide the iron for her while the machine did the work. I selected a hot iron, and putting the young lady directly in front of the machine I stood behind her so that I could guide the tongs with one hand. Together we made a jab at the dies and the gib was made, at the same time the young lady gave a scream and threw her hands up to her face and fell against me still screeching at the top of her voice. I was paralyzed for an instant, until she explained with the tears streaming down her face that something had hit her on the nose and nearly knocked her head off. Further she wanted to know if her nose wasn't flat against her face, and upon being assured it was not she quieted down.

The fact was, a piece of hot scale from the iron had flown from the header and had lodged on her nose she gave me credit for knowing beforehand that it would occur and she said that was why I was so very anxious to let her make one of those horrid things. I pacified her by cutting the gib off, about 2 ins. long, and giving it to her as a souvenir and assuring her at the same time that she was the only one in America in her class.

We passed on to our big bending machine, and as I took special pride in it I thought it would be a good chance to give the ladies a comprehensive history of the machine. "Now, ladies," I said, "this is what is called a 'bull-dozer!'" I looked round to see the effect of my words. They had a special die on the machine to punch and slot channels, used for spring seats. As it may be of interest to your readers, I give sketches of the channel and form in Figs. 4 and 5. The channel is Fig. 4, and Fig. 5 the die, with two views front and side, Fig. 6 shows the arrangement of punches and knife, the gauges are shown in Fig. 7. This die is a great saving, as a good machine with this rig will punch and slot channels cold. To ease the machine the slotting knife should be set 1 in. ahead of both punches



BLACKSMITH TOOLS AND APPLIANCES

and one punch ½ in. ahead of its mate, the machine should be well braced or the rebound will cause it to get out of line with the countershaft.

I noticed that the girls were rather nonplused at my mention of a "bull dozer," so I ordered the man to punch a bar as an exhibition, and he proceeded to do so with the result that the whole party was struck with wonderment at the great power which the machine exerted. The slides looked dry. I advised the man in charge to oil it up while I got the piece cut out of the slot a d the punchings, to show the girls.

Now it happened that one of the girls was acquainted with the young man helping on the machine and had gone over on that side to have a little chat with him while he stood with his foot on the slide waiting for the operator to finish oiling. He was deeply engrossed, looking into the bright eyes and pleasing countenance of his "Bedelia." The man oiling not noticing his position I was startled by a yell which caused general consternation.

The machine after punching the last bar had run over and stopped just on the top center and the operator, to get at an oil hole, turned the balance wheels, and as the crosshead was quite loose on the slides, the weight of the arms had carried it forward and caught the helper's foot between crosshead and die and held him tight, yelling with all his might, the young lady near him trying her best to pull him out. One young lady on my side made a very graceful effort to faint, but was very careful to fall into one of her companion's arms.

I backed the crosshead away from the foot and he fell against "Bedelia" with a groan.

Bracing myself for the next ordeal I put myself at the head of my fair but somewhat nervous charges and piloted them to the steam hammer. Our hammer man was bending coach equalizers on a die we had got up for the purpose, and as it is the only one of the kind I ever saw, I send sketch. Fig. 8 shows two views of the bar to be bent, and of course drawn that shape with a pair of flat dies. Fig. 9 shows the top and bottom die and bar in place ready for bending. Fig. 10 shows the bar after bending, and Fig. 11, the finished end. The bar after bending is taken to a face plate, the end and sides trimmed off at *A*, Fig. 10. This is all done at one heat. When a furnace is used for heating the bars, and when handled quickly a very pretty job is done with a wonderful saving of time.

Our hammer boy was up to all kinds of devilment and enjoyed a practical joke. He eventually got the whole party "on the run" by a dexterous manipulation of a rather complicated exhaust apparatus, and no explanation on my part could restore order or bring them back to the shop.

T. Toot.

SHEET IRON AND WOOD MODEL OF ENGINE FOR EIGHT-HOUR DAY CELEBRATION.

Eight-Hour Celebration in Sydney.

Editor:

Under separate cover I send you photograph of a model locomotive built by the drivers and firemen employed at Sydney, N. S. W., depot, for the purpose of taking part in eight-hour demonstration. This day is labor's day throughout the state, and is held annually to commemorate the adoption of eight-hour principle to all trades. I am pleased to say that the drivers and firemen are under this beneficent principle. Under separate cover I also send you a copy of a monthly paper issued by the Grand Council of Railway and Tramway Unions; you will see by its contents that the air brake question has a very prominent part in its columns, the reproduced photograph of the model engine is a very crude specimen of printing and I am afraid it will show up very poorly against those given in your valuable paper.

You will see by the size of the engine, and no doubt will agree that this was no play-toy affair, and for amateurr in this line of business I am pleased to say it was an entire success. We may excel in so far as running a locomotive is concerned, but when it comes to building, although only wood and sheet iron it is quite a different matter, however, willing hands and plenty of enthusiasm got over the difficulty. In the photograph you will see "yours truly" the third from right side of picture.

A. Percival.

Sydney, N. S. W.

OLD FASHIONED ROUNDHOUSE AT MONCTON, N. B., WITH HIGH, CONE-SHAPED VENTILATOR—INTERCOLONIAL RAILWAY OF CANADA—NOW REPLACED BY A MODERN SHOP.

Valve Motion Model.

Editor:

As I have been a reader of your Railway and Locomotive Engineering for quite a number of years, I send you a blue print of an improvement on the Walschaert valve gear, patent applied, which I will explain later on. I am giving lessons in valve motion and breakdowns on the Southern Pacific at present. I am an engineer on the Coast Division, member No. 161, B. L. E. I have a model of an engine cylinder 12x18 ins. I find about 99 per cent. of firemen do not know what the effect of the angularity of the connecting rod means, so I have a connecting rod 36 ins., being four times the crank of cylinder with 18 in. stroke, and a single eccentric. I have travel of valve about 2¾ ins., ¾ in. out-

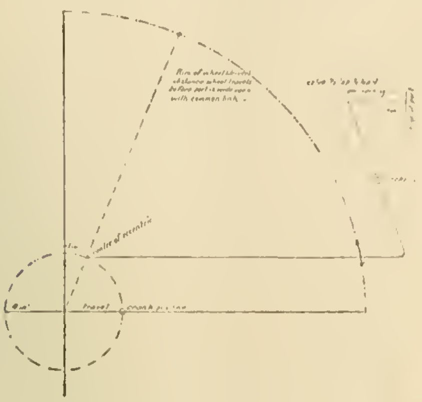


DIAGRAM WITH ORDINARY LINK.

side and ⅛ in. side lap, lead 1-16, cuts off one end 8 ins., the other end 11 ins.

When I get through showing the boys with plumb line where the crank pin is when the piston is in center of the cylinder, and where the eccentric is and where it ought to be for equalized cut-off, and the difference in the lead to give the cut-off, I have no trouble with the link calling their attention to the position of saddle pin showing how easy we can have equalized cut-off at half stroke. Some of the boys have been reading your paper for from eight months to a year, and I have always recommended it. Not one of the firemen could tell me about the angularity of the main rod. Only a few days ago my fireman who has fired East and also on the Coast Division, said he never found an engineer who could explain the angularity of the main rod. I have a link of 18 ins. radius and one of 54 ins. radius. One main rod 72 ins. long and one 36 ins. long; frame 11 ft. long made of 4x4 in. pine; two sets of driving boxes; one driving wheel and 4 ins. driving axle.

Using the short main rod and short

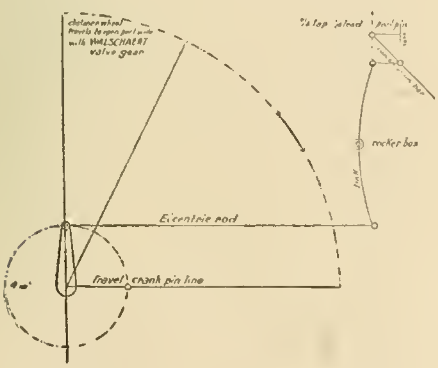
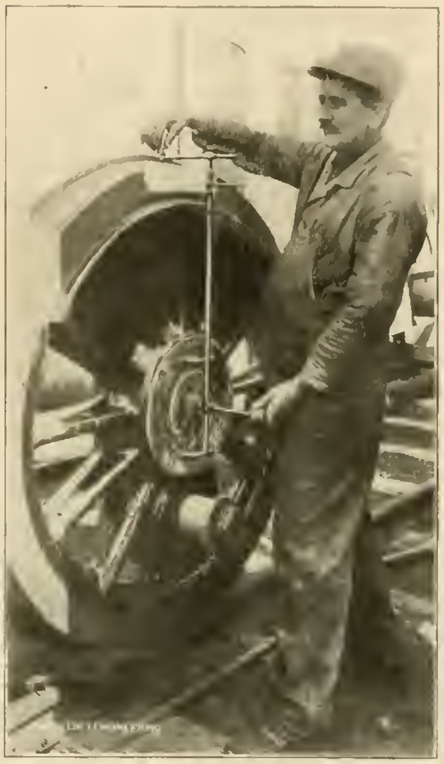


DIAGRAM WITH WALSCHÄERT GEAR.

radius link and then moving it back to the position to use the 72 ins. rod and 54 in. radius link to show the difference of increase of with long and short radius link, so I have first common stationary, second very short rod and very short radius link, third very long rod and long radius link, and also the Walschaert valve motion and when I get through with the boys I see quite a number of the old engineers are going away back and sitting down. Some of them have been starting arguments with the firemen and have been wrong in all of them and have quit arguing now entirely. I am only explaining Auchincloss' works, and he is my authority on link and valve motion. W. R. D. S. P.

Boulder Creek, Col.



DRIVING WHEEL TIRE CALIPER USED IN THE OSWEGO SHOPS OF THE R. W. & O.

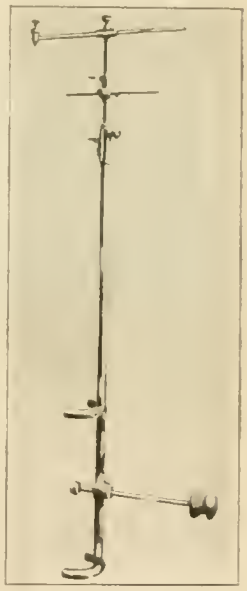
Courtesy W. O. Thompson, S. M. P.

Hitting the Locomotive Builder.

Editor:

Let me address a few words to a man I want to reach through your columns now:

Mr. Builder: You old crab, you old foxey: you old coward. I hadn't ought to call you "Mister." Come out and fight. Come down to the round house; get down in the pit. Oh, you won't eh? Then, come up in the cab. Your rheumatism prevents you from climbing, does it? Well then, stand still, dad durn you (that's what you've been doing anyway). You say you've been moving? Backwards, perhaps. You are afraid to go ahead. Well, stand still then. We can show you plenty, if you just come alongside of your last masterpiece. You never served your time through, and you can't show your apprentice certificate. Do you see that frame? The very foundation that you expect to carry that $20,000 engine for ten years. Do you see those spring hangers bedding themselves into it, and industriously sawing away like a convict in prison? Do you see that little expansion pad digging down from the top, like a grave-digger? They are spoiling your foundation. You say it is just the same arrangement as heretofore. We learned, when in the school room that two sounds of equal intensity produced silence, that two lights produced darkness, but never that two had jobs made a good one. So, fix it. Learn from the sea captain of the ocean liner or the master of a fishing smack that he needs a buffer to protect his boat. Take a piece of No. 8 scrap boiler iron and put it around the frame hot, where something might rub it. We can put on a new one in a few minutes when it wears out. Tack a little steel shim on the frame where the buckles will come ¼ in. thick. When she comes in for an overhauling, we will put on a new one for 40 cents instead of a new center in the frame, and the engine will ride better in the meantime, especially if you put rollers under your springs. Who told you we didn't need rollers under springs of under-hung engines? Surely, no one that ever rode one. Your old frames break anyway, and you know why. We didn't until we had etched a few and found you had made certain sections by chopping them out, or perhaps you have a scroll saw that you use for this purpose, leaving a large part of it cross grained. Your boss blacksmith didn't tell you it was the best, did he? Now, own up, he told you it was cheaper and quicker, and you said: "Quicker goes, we have a rush order for Japan."



GOOD DRIVING WHEEL TIRE CALIPER.

We are not through with you yet. We have seen $100,000 worth of your modern productions standing in one line with broken cylinders. You say: "That's strange." We think so, too. Why don't you make your castings soft so they won't break and put on a chilled false valve seat? (We all have surface grinders to face them.) Bush the cylinder to make it as hard as you can conveniently machine it, and we will take care of it afterward. Turn all your engines out with 1/4 in. of pure block tin on the crossheads and don't forget to leave in a couple of liners, especially when your forward block is cast to back cylinder head. Don't say you think brass is better, because you can't prove it.

Don't bother about putting in a case-hardened knuckle bushing; they freeze and cut, and we can't renew them; the store department only gets one consignment of ground bone per year and we can't wait—brass is cheaper anyway. Put a brass liner on the face of a wrought-iron or cast-steel shoe and wedge. The new liner will wear better, won't cut, won't break, will cost only $1.00, and a new cast-iron wedge costs four. The latter will wear out; the former will last forever. Bolt the front of your iron cab to the boiler to stay; you don't need any slots for expansion—the front is flexible enough for that.

I'm sorry I couldn't get you up in the cab, you old coward. If you should have happened up there when we were trying to pack one of the back cock tc the fountain that you put on before you did the cab or put them on like crown bars, back one first and backed up, we would have taken a pull at your whiskers or cut them off and used them to keep from burning our hands. If you happen to see an engine with a trap door in the roof of the cab and don't find it on the blue print, you may know it was put there so the machinist could pack those cocks. The engineer also goes out the front window and opens it, to open the air pump throttle and the fireman to open the blower. (Patent of trap door held by Jess Taylor, engineer.) Don't be so ——— stingy with your nuts when bolting iron cabs and running boards to their brackets. Put on two and make them 5/8 instead of 1/2 in. Don't put the foot of the bracket up under the lagging and jacket and pipes. Turn it over so we can get at it without spending $40.00 and make it heavier and put in four studs instead of two. If you put on wooden running boards, put in bolts with a head 1 1/2 in. square so they won't turn round and pull through. Carriage bolts were made for carriage builders. Why do you use them on locomotives? You ought to be arrested for it. Go back to the practice of your grand dad, when he fastened the tires on so they wouldn't come off. Many a poor engineer has had to serve time because he got them a little too warm coming down over steep grades (which would cost too much to reduce), and it is many an uncomplimentary remark he made about your system of shrinkage vs. retaining rings.

Throw away that old spool binder and "go away back and sit down," and reflect that it was a dirty trick you served us when you made a casting instead of a forging. Four thousand broken frames are charged to it, too. Then, that spool (synonym, fool), binder prevented us from using the good old wedge bolt that screwed through the binder with a jam nut on the bottom and a square on lower end of bolt that could be reached from inside or outside. Those new fangled concerns are no good and the engineers don't know whether to screw them up or down to set up a wedge.

When you put up your side rods, put a couple of washers between the end of pin and the cap when they get too much lateral. Well, take one out and you won't see so much tin on the end of the brass, which costs more and takes time. You had better go and borrow one of those car builder fellows and get him on your staff. I mean the one with the pressed steel bee in his bonnet. Get him to show you how to make a pressed steel cab bracket. If it bends, we can straighten it and the foundry can go on getting out wheels. Put a steel top on your deck casting, so if the casting breaks, it will be already patched. And he'll make you a lot of other brackets and steps and things that are better and cheaper than your old castings made of scrap car wheels and armor plate that break all the drills we can get hold of. And that fool draughtsman of yours. He couldn't repair a plow. Get him a steel templet of a monkey wrench in size to the scale he uses, and when he draws a nut on the tracing, have him show in dotted lines the path of the wrench. Of course, he won't like his job, but neither does the repair man who has to put on and take off the real nuts he works in on paper.

And you old duffer, you've got a lot to learn about making a tender. Did you ever notice one that had been in service a year or two, decorated with large and small ash hoes, garden spades and Bryan's 16 to 1 dollars riveted on by a boilermaker, whose mind don't run on beauty or symmetry? They are there because you placed a row of stiffening angle irons up and down the side of the tank to fasten your water brakes to and you left a hinge bewteen the two and there are 10,000 patches applied over the country because you didn't break joints or put in a corner bracket to keep it from working. Finally, some of you did take a tumble and you put them lengthwise; but you failed to run them around the corner and you left the same vulnerable spot in a different place.

Then, I am not through with you yet; you ridicule fads, but you are the "worst ever." You have carred the heating surface fad so far that you have got all heating surface and no room to put anything to heat. You have built fire boxes so wide, that you coul'n't get drivers under them and you had to put little dinkey wheels in and then you made them go, by calling them "Atlantic" and "Pacific," etc. You got them so wide, that they won't go into the round house or tunnels and consequently so high that we have to provide a horse block for the engineers to mount them, and the machinists made a demand for 2 1/2 cents per hour additional for having to work in so dangerous a place up in the sky. To get a little more heating surface, your water space reminds us of the big liar's barn, which was a thousand feet long and an inch wide. Then, think of it. You put your gauge cocks on the side of it and you make gray hairs for every engineer who happens to try his gauge cock while going around a curve having 3 ins. of elevation to 4 ft. 8 1/2 ins. increased by the reverse of the figures or 8 ft. 4 ins. Not only this, but who raised the crown sheets? Let him come out and I'll guarantee he gets a fine black eye before he gets back in his hole.

One of your dad durn draughtsmen stole our fillets and gave us square corners. If he has no tools but a T square and a rule, we'll buy him a pair of dividers pay-day. You had better take a tumble to yourself, and fix some of these things and you will get more foreign orders.

Moral: Every builder ought to be a round house machinist and the draughtsman his helper first.

D. P. Kellogg.

Bakersfield, Cal.

How They Did It Long Ago.

Editor:

Your paper is almost the only one of its class that ever puts in a word in a lighter vein which, with its quotations from the great authors, is highly appreciated by myself and others as a little silver thread upon the stern steel of strenuous business. So I will write you a little reminiscence of a day when mastodon engines and tonnage trains were not yet born and "frenzied finance" of railways did not insert the prod so deep or nag the terrified engineer or trainmen clear off their feet, as is so common at present.

A few years ago Railway and Locomotive Engineering published a series of pictures of the early locomotives of American build, among which was the first Schenectady engine named the Governor Marcy and sold to the Michigan Southern and Northern Indiana, now the L. S. & M. S.; it was a good-sized engine of its time, 1852, cylinders 13x20 ins., and a V hook motion, and the only furniture in the cab on the boiler head was three gauge cocks, two heater cocks, a pair of spring scales for regulating steam pressure and throttle lever; rather simple, wasn't it? The steam dome was next to the cab, over crown sheet, and on top of dome a bright copper steam escape pipe.

Old Tom S., a real son of the evergreen isle, was the engineer. Active and witty as so many of them were, and a lover of an amber beverage much favored by our teutonic brethren. Well, one day Tom came into the possession of a "quarther" from some good-natured conductor and proceeded to invest it all in a pail of the aforesaid beverage, the pail being the engine metal bucket. The day was bitterly cold and so were the refreshments, and Tom proposed to raise the temperature of himself by raising that of his purchase. So on top of the cab he goes, and holding the bucket over the safety valves and down into the "scape" pipe he called on his fireman to let off a little "stame," which he could do by turning the thumb screw on end of safety valve lever. This bucket fitted like a bullet in a gun barrel into the "scape" pipe unless held near the top, and the following is what occurred:

Tom, from top of cab, temperature twenty below: "Garge, do ye let off a little stame."

"All right, Tom," at the same time with one hand holding down the lever and turning up the thumb screw with the other.

Tom—"P'hwy don't you let off some stame?"

Garge—"Are you ready, Tom?"

Tom—"Yes, hurry up; I am perishing with cowld."

Garge—"Ain't you ready yet?"

Tom—"Dom your little Yankee sowl, let off the stame or I'll kill you."

Tom by this time had got tired of holding the heavy bucket and it had come to a rest down in the "scape" pipe. Garge let go the lever, the valve jumped a half inch off its seat and bucket and contents went skyward. Tom rolled off the cab onto the wood in the tender below and the fireman flew from the wrath of Tom and the punishment justly due him, only to have it meted out to him with interest when he did return, and as a penance, scour the whistle twice a day for two weeks. G. H. B.

Dubuque, Ia.

Wants the "Eddy Clock" Preserved.

Editor:

I have been a subscriber to your journal for twelve years and am very much pleased to notice in your January number a cutting in respect to the Purdue University obtaining the historic locomotive "Daniel Nason." I have seen this locomotive many times and have wished that some university could have the same in its possession, as it has been rusting away in a roundhouse of the New Haven system out in the country.

I wish it could be brought about so that this university or some other could obtain possession of the only Eddy clock now in existence, No. 39, on the Boston & Albany, which is now at Worcester and used for supplying steam for heating passenger coaches. This locomotive is in its original condition and has never been altered. It is certainly a curiosity and is worthy of a place in any collection of antiquities.

John Worcester Merrill.

Unfair Comparison.

Editor:

May I say, for the benefit of Mr. Ord, locomotive engineer of the Canadian Pacific Railway, who speaks about "Electric vs. Steam Locomotive," in the January number of your magazine, that the New York Central Railroad locomotive, "Mohawk," is used as an observation engine for officials of that road, was not built for very fast speed nor for pulling trains, and does not begin to equal their average passenger locomotive either in size or tractive power. Therefore, it could hardly be expected to do anything remarkable in the way of racing against an electric locomotive of over 2,000 h.p.

J. F. Knox,
American Locomotive Inspector.

Coatesville, Pa.

Automatic Stop Signal.

Editor:

Inclosed please find plans, etc., of an invention "To prevent engine drivers passing danger signal," of which I wrote some considerable time ago, promising to let you have them when I got them from the Patent Office. It is some eight months since I received from there, but delayed sending to you until I got word back from London regarding a trial, etc. Well, so far I have not received any word as to how far they have got with it, and, as I do not know how much longer I will need to wait, I think it is about time I fulfilled my promise to you.

As it was from reading your article on this matter in the Railway and Locomotive Engineering in March, 1903, that I got the idea, I would ask you, after examination of plans, etc., to kindly give me your candid opinion as to what you think of it, if it is a "good plan" or not, for I am sure, with your wide experience in such matters, you will be able at once to report on its merit.

I have had a number of letters from "Patent" agents from your city, but again your valuable paper has helped me in the warning it gave regarding these people. T. Cairns.

Auckland, New Zealand.

[A description of this device will be found in another column. Our readers are invited to express their opinions as to its merits.—Ed.]

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Irrepressible Railway Accidents.

The railway subject that has been most fertile of discussion during the last three months has been that of railway accidents. The number of people who are killed or maimed on our railways are remarkably few considering the vast mass of passengers carried. They are few in proportion to the fatal accidents that happen to people riding in horse drawn vehicles, but they are so much more numerous proportionately than the railway accidents in other countries that President Roosevelt was moved to comment on it in his message to Congress, which has given new vigor to the controversy.

In this connection it was our intention to discuss last month, a paper read by Mr. Slason Thompson before the Western Railway Club, but circumstances beyond our control prevented this, and we now take up the subject after it has become somewhat threadbare. The paper is on American and British Railway Accidents and its purpose is to prove that railway travel in the United States is really safer than it is in the British Isles, notwithstanding the reports, articles and allegations seeking to prove the contrary. Mr. Thompson makes a somewhat savage attack on the Interstate Commerce Commission and accuses them of publishing sensational reports and attempting with "ghoulish glee" to fill the public mind with horror over the harrowing totals of every description of frightful and terrible railroad accidents. The policy of the Interstate Commerce Commission in making reports of railway accidents is contrasted with the practice of the British Board of Trade, very much to the disadvantage of the American side. He insists that the British officials prepare their reports to impress upon railway companies how accidents could be avoided, but that the Interstate Commerce Commission endeavors to place unnecessary blame upon the railroad companies and tries to inflame the public opinion against the companies who were unfortunate enough to have had fatal accidents to their trains. The Interstate Commerce Commission is also accused of deliberately perverting their reports to further a preconceived and fallacious theory, as to the best means to prevent railroad accidents. The gross totals of accidents he alleges, have been paraded before the popular imagination as the frightful mortality to be reduced by block signals, whose inevitable tendency, he says, is to beget carelessness in the train crews as it shifts responsibility to the signal operators or to the signal itself.

This is a very severe arraignment to be made in a paper submitted for the information of members of a railway club, and it is far from being logical; for if block signals tend to make our railway men careless and thereby increase accidents, it ought to have the same effect in Great Britain where railway accidents are less frequent than they are in any other country. Mr. Thompson, however, does not admit that people are carried more safely in the British Isles than they are in the United States and to prove that contention he says that on 35 railroads operating over 31,000 miles which carried 4,886,641,267 passengers one mile without a single life being lost. Other selections of roads were made that carried passengers with remarkably few accidents. He admits that there have been railway accidents and that some improved supervision is necessary, but he wants the reform to begin by removing the whole subject of railway accidents away from the hands of the Interstate Commerce Commission.

Picking out railways that have been free from accidents and offering them as examples of how the work of carrying passengers is performed and as a basis of comparison with British railway casualties will hardly be regarded as fair, for there is no denying the fact that in the last six months of 1904, 252 persons were killed and over 500 injured on our railroads. Mr. Thompson lays great stress on the greater length of mileage covered by our railway system, but more mileage does not necessarily increase the chances of accidents. The amount of business transacted and the number of trains run make the proper basis for comparison.

There is no question that railway accidents are very numerous in the United States and that being the case it is the wise plan to agitate for remedies rather than to mystify the facts. If it is true that in a multitude of counselors there is wisdom, railroad companies ought to be well informed at present, for nearly every publication of any consequence in the country has discoursed on railroad accidents, their causes and remedy. A cynical remedy offered by the press of Great Britain, when railroad accidents were relatively more common than they are nowadays, was to carry a director on the buffer beam of the locomotive. The parsimony which that recommendation was meant to cure is not what our railways are suffering from, for such accidents as collisions and running into open switches are common on roads where no expense has been spared on safety appliances.

Among the many really able articles that have appeared recently on railroad accidents there are two that deserve the earnest attention of railroad managers. It may be presumed that Secretary Moseley of the Interstate Commerce Commission would give the subject of railroad accidents earnest and intelligent consideration, and that his views would be valuable to the traveling public. They have been expressed in an article in the *Review of Reviews* and turn principally upon the necessity for extending block signals and restraining the use of the permissive block system. More block signals properly operated would help, but even block signals have their limitations.

A much more comprehensive grasp of the subject of railway accidents was displayed in an article contributed by Mr. F. W. Haskell to the *Engineering Magazine*. Mr. Haskell is an old railroad official now in other business, so he is untrammeled in expressing views of practices that long intimacy with details of the duties performed by all classes of railroad men has made him a good authority upon. He combats the assertions so frequently heard that corporations permit accidents to happen through the use of inferior materials or through want of safety appliances, and holds that such practices do not pay, which prevents them from being practiced. Very few accidents, he maintains, are caused by defective material or equipment. A vast majority of them result from errors in handling trains. The handling of trains is governed by standard rules. Why, then, do we have the almost daily murder of passengers from preventable accidents? Because the admirable rules for the government of employees are habitually disregarded.

That answer, Mr. Haskell maintains, is a true summary of the leading cause of railroad accidents and he proceeds to give instances of neglect from a well-stored memory. We are all familiar with the saying, "Rules are made to locate blame when an accident happens;" but the man who takes no chances and tries faithfully to obey the rules soon makes himself unpopular. The chances are that his life will not be long upon any railroad. The strong individuality of Americans tends to develop the chance-taker, and it moves the official in charge to overlook breaches of rules that do not end in disaster.

All the agitation against railway accidents is kept at a fever heat, but the accidents keep recurring and the traveling public hopelessly exclaim: What are we going to do about it? Very little, for a condition and not a theory confronts the investigator. The condition is the natural want of obedience to laws and rules. Block signals, perfect brakes and strong cars will reduce the fatalities of collisions, but the real remedy is to cultivate obedience to constituted authority.

Railroad President Favors Government Control.

Several years ago a sensation was created in railway centers by A. B. Stickney, president of the Chicago Great Western, charging his associates at a meeting of railroad presidents with coming together to make working agreements that they had no intention of keeping.

Mr. Stickney is not celebrated as a harmonizer, but he is highly practical in shaping railroad policy. While most of the railway officials are merely offering strenuous objections to giving the Interstate Commerce Commission power to regulate railroad rates, Mr. Stickney has declared that the Government should either own and operate the railway lines or supervise and regulate their management. The latter, he thought, the wiser plan and to be preferred. "The railroads, after all, are as much the subject of government control as the public highways," he added.

Greatly added powers for the Interstate Commerce Commission were advocated by Mr. Stickney at the committee hearing in Washington last month. "There is plenty of law, no doubt, in the interstate commerce act," he says, "but the Interstate Commerce Commission itself lacks potency.

"The results of the law have been beneficial, and it was one of the greatest pieces of legislation ever enacted. At the same time, it is but dimly understood and appreciated by vast numbers and especially by freight agents. It ought to be strengthened in several ways, and the commission ought to be given a great deal more money so as to make it really efficient."

Breaking Trains in Two.

One of the most annoying and distressing happenings in daily railroad work is the breaking-in-two of trains. Perhaps the most vexatious experience is the breaking-in-two of the heavy modern passenger trains, which necessarily entails much loss of time, unsatisfactory completion of work in coupling the train together again, and for which work the crew have facilities which are not always adequate or sufficient. The breaking-in-two of trains has always been with us, and has been considered in the light of almost a necessary evil. Every caboose and engine from time immemorial has been equipped with an outfit for recoupling freight trains which have broken-in-two at the draw bar, end sill, or other connecting part.

In the earlier days when lighter cars were used, and the draw springs were of lower capacity, break-in-twos were not so frequent unless the slack was quickly taken out of the train by the engine in starting. In modern practice, however, break-in-two troubles are greater than in earlier times. It appears that while cars and locomotives have been steadily growing larger and heavier the true service capacity of the draft gear connections have not increased proportionately, nor is this logically possible when we consider that not alone the parts of the draft gear system must be made heavier and stronger, but that the resistance to withstand shocks be also increased. The way in which this increased capacity is usually attempted, is by increasing the capacity of the draft spring by substituting a larger and stronger spring, or by placing two springs where one was formerly used.

Enlarging the parts such as knuckles, coupler shanks and tail pins, is undoubtedly a move in the right direction, but an enlargement of the spring capacity is manifestly a temporary expedient, if not altogether a move in the wrong direction. The spring in the draw gear, when compressed by the shock, must naturally recoil or "kick back" with almost the same force that it was compressed by the shock. This means a counter shock and a series of succeeding shocks and counter shocks throughout the train which is bound to compress some of the springs solid to their full capacity, and then throw the shock as a dead weight on the under framing of the car. When this shock to the under framing and end sills is too great to stand, the parts give way

The principle of spring resistance in the draw gear is manifestly incorrect, for the reason that while it can absorb one shock, this shock will form itself into a counter shock which does great damage. If the initial shock could be arrested and consumed, and the recoil or "kick back" prevented, an ideal resistance would be had. This feature is claimed to exist in the friction type of draft gear, as that type absorbs the shock, through friction, and consumes the energy which would otherwise be given back in the counter shock or recoil. This is a subject which has been before the Master Car Builders' committees for some time, but no definite conclusion regarding its true value in comparison with the spring gear has been reached as yet. This would seem a matter of exceeding importance to railroads troubled with break-in-twos on heavy modern equipment.

Many of the break-in-two troubles blamed on the engineer, and for which he is obliged to "do time," is actually due to the inefficiency of the draw gear. In a few words, the heavy car and locomotive equipment have grown much faster than the helpful capacity of the draft gear. Again, the simple spring gear, suited perhaps to very light trains many years ago, cannot be developed, on account of its reactive tendencies, to meet the needs of the heavy shocks of long, heavy trains of to-day. Something is needed to absorb and consume the shock and thereby prevent the damaging recoil of the draft springs, instead of permitting it to "kick back" with the disastrous effect on the draft gear springs and throwing excessive strains on the foundation timbers of the cars, which necessarily must result in their giving way to fracture at some point.

Many break-in-twos, blamed on the air brake, is really due to inefficient draw gear, which permits the train to part, the air brakes applying incidentally as they are intended to do, and they are wrongly blamed for bringing about the damage. A better quality of draft gear is certainly desirable on our heavy modern equipment.

Clean Trains and Filthy Engines.

The passenger department of most American railways appreciate the advantage of having attractive looking cars, and little expense is spared in the race of competition to make the trains as handsome as possible. At great terminal points, where travelers have the opportunity to compare the outward appearance of trains belonging to competing systems, there is no doubt that the railway company with the finest looking cars gets business on that account. The attractive part of the train is, however, often entirely behind the tender of the locomotive. The engine and tender are frequently monuments of power encased in the dirtiest covering that neglect and want of taste can provide. We have no desire to see a return to the gilt and tinsel that were for many years employed to make locomotives look ostentatious, but we really represent public sentiment in saying that the severe simplicity of modern fashion should be accompanied by cleanliness.

We recently traveled on a railway that had most attractive passenger cars inside and outside. There was nothing ostentatious, but there was sufficient creature comfort to please the eye and other elements of sensation. But the locomotives were a sight to be remembered. There seemed to be great uniformity in their uncouth appearance. The boilers looked as if they had been foamed over for a year and then lavishly coated with coal dust. The machinery—rods, cross-heads and guides—had originally been bright, but they had been neglected so persistently by the wipers that they had become masses of moving filth. The wheels still showed spokes, but, like other parts, they were heavily loaded with antiquated grease, track clay and coal dust.

The passenger department of our railways no doubt understand their business, and they have insisted that trains be made attractive because it is a paying proposition. Would giving an attractive appearance to the engine pulling the train not possess a paying feature? When traveling people look at a locomotive in front of a train and find it an eloquent testimony of neglect and slovenliness, are they not likely to reason that the carlessness which fails to remove dirt is likely to leave defects unremedied that are liable to cause failure on the road? Such reasoning is entirely rational and logical. As getting safely and expeditiously to the end of the journey is the aim of travelers, motive power that proclaims neglect and carelessness is likely to send passengers by other routes.

Meeting of the American Society of Mechanical Engineers—Address by President Swasey.

Early in December last the fiftieth meeting of the American Society of Mechanical Engineers was held in New York, and an address on "Some Refinements of Mechanical Science" was delivered by the president of the society, Mr. Ambrose Swasey.

The speaker congratulated the society on the creditable record of its 25 years of existence, and for its membership of nearly 2,900. The principal part of the address dealt with the developing and perfecting of mechanisms and instruments. He traced the progress of time measuring devices from the sun-dial, the hour-glass, the water clock up to chronometers of to-day in which practical, if not absolute perfection, has been attained. The growth and perfecting of astronomical instruments was next touched on. Reference was made to the dividing engine made by Ramsden in 1777. This engine was designed specially for the graduating circles, and is now preserved in the museum of the Smithsonian Institution, at Washington.

In dealing with machines for ruling lines exactly parallel and equally spaced, he said that Professor Rowland had made an engine which has a practically perfect screw. To use Mr. Swasey's own words: "This engine was made especially for ruling diffraction gratings of speculum metal, and with it a surface has been ruled with 160,000 lines, there being about 29,000 to the inch, and as many as 43,000 lines to the inch have been ruled. The gratings mostly used have from 14,000 to 20,000 lines to the inch, and with such exactness is the cutting tool moved by the screw that the greatest error in the ruling does not exceed one-millionth of an inch."

Continuing, he spoke in part as follows:

"The established standards of length, which are the yard of Great Britain and the meter of France, being made of metal and liable to destruction or damage. Professor Michelson conceived the idea of determining the lengths of these standards in wave lengths of light, which would be a basis of value unalterable and indestructible. For these experiments the interferometer was constructed, an instrument which required the highest order of workmanship and the greatest skill of the optician. Mr. Brashear made for the instrument a series of refracting plates, the surfaces of which were flat within one-twentieth of a wave length of light, with sides parallel within one second. This was the most difficult work ever attempted in the refinement of optical surfaces.

"Professors Michelson and Morley devised a method for using the interferometer for making the wave length of some definite light an actual and practical standard of length, and experiments were conducted at the Bureau of Weights and Measures at Sèvres, France, where the standard meter, kept in an underground vault and inspected only at long intervals, was used for that important work, which occupied nearly a year. The final result of the experiments shows that there are 1,553,164.5 wave lengths of red cadmium light in the French standard meter at 15 degrees C. So great is the accuracy of these experiments that they can be repeated within one part in two millions. Should the material standard of length be damaged or destroyed the standard wave length of light will remain unaltered as a basis from which an exact duplicate of the original standard can be made. These two marvelous instruments, the Rowland dividing engine and the Michelson interferometer, show the possibilities in the perfection of linear divisions and the standards of length."

The Fatal Open Switch.

Running into an open switch is one of the most fertile causes of fatal accidents in railroad operating, and it is always caused by inexcusable carlessness. Men who go away and leave a switch open ought to have no mercy shown them, and it is a case where laws ought to be passed awarding severe punishment to the man guilty of committing such an offense, no matter it if led to an accident or not.

Holding these sentiments, we were not a little surprised to read about a superintendent of St. Louis terminals denying that a man sent to guard a switch was guilty of gross carelessness when he went away, leaving the switch open, causing an accident in which several persons were severely injured, one of them fatally. The superintendent who defended this kind of railroading is probably the type of man who demoralizes the employees by habitually overlooking breaches of discipline so that they may pose as good fellows.

Wallace's Hand Book.

"Points for Men on the Head End," is the name of a new pocket reference book, by our occasional correspondent, W. G. Wallace, and published by The World Railway Publishing Company, Chicago, Ill. The publishers make a point on the practical character of the book, and their claim in this respect is well founded. The author writes advice to the men as plainly as he would speak it in the roundhouse or on the road.

Contains information on instruction to firemen; running; how to make engines steam; care of rods, wedges, driving boxes; getting over the road; lubrication, emergencies, etc.

Teaches how to figure tractive power, train resistance due to curves, grade, speed and many other things. Price $1.00.

We have received a copy of the forty-sixth annual report of the Railroad Commissioners of the State of Maine. It is a book of 364 pages and contains statistical tables from the annual returns of the railroad companies operating in the State during the year ending June 30, 1904. In the work are included petitions and the decisions and rules of the board. The commissioners for the State are Messrs. Joseph P. Peaks, B. F. Chadbourne and Parker Spofford.

The Tug-o'-War.

BY DAN DUGAN.

Their general appearance—ruddy-faced, well fed, well groomed, and in tourist outfits—told the general manager that they were Englishmen touring America the moment they were ushered through the green swinging door into the inner office. This was apparent before the spokesman said:

"Beg pawdon, suh, but I take it from your clark's statement outside, that you ah the General Executive officah of this railway, from which we have just alighted?"

"Yes, if you came in on the Midland railroad. I am general manager of that line, sir," replied the G. M., taking another look at the card which Burns, the chief clerk, had brought in. "And you are Sir Joseph Johnstone, of London, England?"

"Yes, and my associate and companion heah, is Suh Samuel Jenkins, also of London."

"I am delighted, gentlemen," acknowledged the General Manager. "Pray, be seated."

The two Englishmen sank into the luxurious leather chairs offered them, and the G. M. resumed: "If I am not mistaken, gentlemen, you are both directors of the London & Northwestern Railway. And you, Sir Joseph, are one of its largest stockholders. I welcome you most cordially, and hasten to extend to you every courtesy, to its fullest extent, that our line affords. Shall I supply you with transportation and escorts, and with introductory letters to our officials? They will be directed to provide you with every facility for investigating our American methods of railroading. You would like to investigate and observe our methods, I presume?"

"Well—er—er—. But I beg pawdon, suh," hesitated Sir Joseph. "We thank you very much, suh. We might appreciate investigating some certain methods of youahs, but not of othahs. I desiah to suggest to you that we have been forced to observe some of youah American methods which we cannot bring ourselves to very much admiah. In fact, we have had a most extraordinary experience—extraordinary, and decidely unpleasant, I assuah you, suh, and we wish to lodge a complaint."

"Indeed?" queried the G. M., with raised eyebrows. "Not a lack of attention and courtesy on the part of our employees, I hope, gentlemen?"

"No, thank you, suh," replied Sir Joseph, hastily, "not that. We have just alighted from your highly advertised fuhst-class train. You call it—ah—ah—yes, the 'Chain Lightning,' I believe. We occupied a private compahtment in one of the luxurious carriages of the 'Chain Lightning,' and were rudely jostled while taking our morning bawth. It was exceedingly provoking, I assure you. There came a terrific shock—terrific, suh, as Suh Samuel emerged from his tub. He was hurled, projectile-like, the entiah length of the compahtment and landed, dripping and swearing, in a very undignified and ludicrous position, mainly on his head—a position vastly unbecoming to an English gentleman, I assuah you."

"It was outrageous, suh, outrageous," interjected Sir Samuel, speaking for the first time, and in a tone which keenly betrayed his lingering indignation at being so unceremoniously handled. "One of your abominable American practices, I presume, suh—abominable, and exceedingly disconcerting, I assuah you."

The G. M.'s brows, knitted closer. Had Burns, the chief clerk, seen it, he would have interpreted it as: "Trouble ahead for somebody."

"High speed brakes—Jennings—trouble," mused the G. M. "That's the fourth time in the past month I have heard that." The brows contracted and knitted closer, and the owner for the moment seemed lost in thought. Trouble was undoubtedly brewing. "Jennings—high speed"——

"But we must be going, suh, now that Suh Samuel has lodged his complaint, or, rawthah, that I have served it foh him," suggested Sir Joseph. "He was deucedly angry, was Suh Samuel, I assure you. He was in a terrible passion and insisted upon formally resenting one of your distasteful methods." And as he shook the G. M.'s hand, Sir Joseph continued: "You should try the automatic vacuum brake, which we use in England, suh. You will find it stops trains with decidedly less shock than your compressed air, high speed brake. Will it not, Sir Samuel?"

WORKING HARD BUT LOOKING PLEASANT—SEE THE MEN ON THE RUNNING BOARD.

There was a merry twinkle in Sir Joseph's eye, he probably cherishing secret amusement at Sir Samuel's predicament of the morning and his consequent discomfiture. Sir Joseph screwed his single eyeglass into place, and leveling it at the G. M., with all the deliberation and care that a gunner would exercise in aiming at a target, said: "I subsequently awsked your chief guard—conductah, I believe you call him—if there was any valid reason for so violently ejecting Suh Samuel from his bawth. He only smiled, howevah, and covertly suggested: 'High Speed Brakes—undesired quick action'—a most decidedly unsatisfactory ansah, I assuah you."

"Decidedly, suh, I assure you," replied Sir Samuel, savagely. "Good mawning, suh."

"Git onto de go-ahead-and-back-up-caps o' dem Johnny Bulls," exclaimed "Phil," the office boy, to Burns, the chief clerk, as the Englishmen, in fore-and-aft peaked tourist caps, accompanied by Washington Lincoln, the colored porter, carrying their luggage, disappeared through the outer door.

That trouble was brewing for Jennings was settled when, in response to the G. M.'s "buzzer," Burns was ordered to summon Jennings. "Send for Burke, the superintendent of motive power, and for Jones, the division superintendent, too," added the G. M.

In due time these worthies arrived and were occupying the places we once before saw them in, viz.: Messrs. Burke and Jones, uncomfortably seated in the luxurious leather cushioned chairs along the wall at the side of the G. M.'s desk, and Jennings standing "on the carpet" in front.

"Several months ago," began the G. M., somewhat severely, "we began equipping with high speed brakes. At the present moment we are about half equipped, I believe. Eh, Mr. Burke?"

"Yes, sir," replied the S. M. P. "That is, all our through trains are equipped and in high speed brake service, and we are now working on our local trains."

"Anyhow," continued the G. M., "our first-class limited trains are all equipped. Eh, Mr. Jones?"

"Yes, sir," replied the Supterintendent, "all through trains, including our two flyers, the 'Chain Lightning' and 'Blue Streak,' are in high speed brake service."

"Those two trains have given us more trouble than all the others combined, and especially since we equipped them with high speed brakes," said the G. M. "Why, less than an hour ago, two English gentlemen, directors and stockholders of a prominent British railroad, traveling over our line, came in here and complained of being knocked down in one of the compartment bathrooms on the 'Chain Lightning' this morning, evidently by irregular action of the high speed brakes."

Here Burns entered and handed the G. M. a message from the general superintendent. It read as follows:

"'Chain Lightning' arrived one hour and forty minutes late. Broke in two three times last hundred and thirty miles. Cause, high speed brakes."

"Ask Mr. Williams to step in. Tell him I wish to see him," said the G. M., brusquely. The Genl. Supt. soon made his appearance.

"Mr. Williams," began the G. M., holding the message before him and slowly re-reading it, "This means that we must pay rebates to the passengers of this morning's 'Chain Lightning,' doesn't it?"

"Yes, sir," replied the Genl. Supt. "Our ticket contract calls for a rebate to ticket-holders whenever the 'Chain Lightning' arrives more than twenty minutes late."

"How many cars were there in the train—and how many passengers?" asked the G. M.

"Fourteen cars," replied the Genl. Supt. "Three baggage, two express, two day coaches and seven sleepers and compartment cars, all solidly filled."

"A pretty penny it will all cost us," said the G. M., dolefully. "Where did these break-in-twos occur?"

"The first was at Pigeon Center, where we are putting in a new steel bridge and have to use single track. The second was at the Hardrock coal chute to take coal. The third was coming over the crossover switches into the station, downstairs. As the 'Chain Lightning' was late, she had to be berthed on another track than her usual one. The yardmaster slowed her down, and she broke in two. She blocked the whole yard and laid the 'Blue Streak' out eighteen minutes. I have already forty-five protests this morning from commuters, and thirteen threats to leave our line and go to the South Shore road. The delays are very damaging, sir, and I would suggest that we discard the high speed brake and go back to the old brake which never gave us this trouble." As the Genl. Supt. finished, his eyes rested rather savagely on Jennings. In fact, all eyes were turned on Jennings, standing in front of the desk, evidently feeling he was up against a decidedly hard proposition.

"What have you got to say, Jennings?" asked the G. M., in a steely tone.

"Don't take off the high speed brakes," replied Jennings. "It would be a mistake."

"A mistake?" retorted the G. M. "A mistake? Would you consider it a mistake to keep the 'Chain Lightning' and 'Blue Streak' on time? Would it be a mistake to stop paying rebates to passengers on limited tickets?"

"And would it be a mistake," added the Genl. Supt., savagely, "to stop paying overtime wages for laying out all the trains on the road?"

"You don't understand me," replied Jennings. "I meant that the trouble is not with the high speed brakes. Taking them off wouldn't bring the relief you might think it would. The trouble is elsewhere."

"Why can t we run high speed brakes without trouble like other roads?" persisted the Genl. Supt. "The New York Central ran the Empire State Express high speed braked for several years without trouble."

"Yes, and the Pennsylvania ran the Congressional Limited for years high speed braked without trouble," added Mr. Jones.

"And both the Burlington and the North-Western have done it, too," suggested Mr. Burke.

"Hold on, gentlemen! Hold on!" interrupted the G. M. "Don't all jump on Jennings at once. Give him a chance. He says the trouble lies elsewhere than with the high speed brake. Where is it, Jennings? Go ahead and tell us where the trouble lies and how we can get rid of it."

"Well," said Jennings, slowly, "to begin with, *the break-in-twos on these high speed braked trains never happen when the brakes are being applied. It is always after the brakes are released.*"

"That's so," volunteered Mr. Jones, "I've noticed that myself."

The Genl. Supt. and G. M. looked a little surprised. "Go on, Jennings," said the G. M., encouragingly.

"You will remember," continued Jennings, "that since we put high speed brakes on the 'Chain Lightning' and 'Blue Streak,' we have just about doubled the length of those two trains. Before our passenger business increased so, and before we got the big 700-class engines, we seldom hauled more than six cars, and never more than eight. To-day fourteen-car trains are common with us. Our flyers, the 'Chain Lightning' and 'Blue Streak,' are now more like freight trains and must be handled more like them. We must be more careful in releasing brakes, and in starting to use steam to take slack after a release of brakes."

"Do you really believe that cuts much figure with a train equipped with M. C. B. automatic couplers?" asked the Genl. Supt. "Won't the couplers take care of the slack in a fourteen-car passenger train?"

"If we handle it right, it will," replied Jennings.

"Well, go on Jennings," directed the G. M., encouragingly, "and tell us how to handle it right."

"The whole trouble comes," continued Jennings, "from what you might call a 'Tug-o'-War' between the brakes on the rear cars and the engine on the head end. Anything which sets up this 'Tug-o'-War' will throw a strain on the draft gear and couplings that is liable to break the train in two somewhere."

"But why should these two forces be playing at 'Tug-o'-War,' Jennings?" asked the G. M. "One force—the engine—is to start and keep the train going, while the other force—the brakes—is to stop the train. I don't see why both forces should be working at once."

"That's it," replied Jennings. "That's the trouble. If we can keep these two opposing forces from working at the same time, we'll not have any break-in-twos. But sometimes they are allowed to work together, and then we have break-in-twos."

"I fail to appreciate Mr. Jennings' point," rejoined the Genl. Supt., with just a tinge of sarcasm in his tone. "Why should any sane man keep on using steam after he sets his brakes? And why should he set his brakes while his steam throttle is wide open? That is out of all reason."

"Understand me, he doesn't do it intentionally, or even knowingly," replied

(Continued on page 74.)

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. When a student wishes to receive a private answer, he is reminded that it is usual to send a stamped envelope for the return letter. We will be glad to answer any question relating to railway matters, but prefer that they be suitable for our question and answer department. All letters intended for Our Correspondence School ought to be addressed to Department E.

Progress of the Course.

We publish in this issue the last of the third series of questions forming the beginning of our Correspondence School Course. We now begin with the first series. The reason why we began at the third series was that it contains the final questions for the examination of firemen who are offering themselves for promotion to be engineers. We had a great many requests that we should give the answers to these questions at once, so that men preparing for examination should have the benefit of them.

All the leading railway companies in the country have decided to require their trainmen to undergo an examination as a test of practical knowledge of the duties they are expected to perform after being promoted. Some companies require the men to pass only one examination; but most of them are instituting a series of three examinations—the progressive examination plan recommended by a committee of the American Master Mechanics' Association in 1891.

If young firemen will take up the study of these questions as the answers are published and keep working at them steadily, a little at a time, they will acquire such strength of knowledge that going before the examination board will have no more terrors than sitting down to air their views before a stove committee.

Few men will obtain employment as firemen or brakemen without passing through an examination to test their eyesight and their ability to write plainly, and to read handwriting fluently. The test of eyesight turns to a great extent upon ability to distinguish colors and this is a test that every man must pass before he is recommended for promotion.

Questions.

95. What causes the drumming sound sometimes heard in the fire box of a soft coal burning locomotive?

96. How can the disagreeable noise be stopped?

97. What are the principal causes that prevent a locomotive boiler from steaming freely?

98. How often does an ordinary locomotive exhaust steam during a revolution of the driving wheels, and at what periods do the exhausts take place?

Answers.

95. The combination of the combustion gases in a form that makes a series of minute explosions creating the drumming sound.

96. By closing a damper or putting the fire door on the latch.

97. Badly adjusted draft appliances, leaky joints in steam pipes, flues choked up, too much piston clearance, valves and piston packing blowing, and irregular boiler feeding or inferior firing, and poor fuel.

98. Four times. Beginning with the right hand piston moving from the forward center and the left crank set one-quarter behind the right hand crank. When the right hand crosshead has moved back to nearly the middle of the guides, the left hand exhausts on forward stroke; when the right hand crosshead reaches close to back of guides, the right hand cylinder exhausts on backward stroke; when the crosshead returning reaches near the middle of the guides, the left hand cylinder exhausts on backward stroke, and when the crosshead reaches close to the forward end of the guides, the right hand cylinder exhausts on the forward stroke. That completes the cycle.

First Series.

1. Do you consider it essential to your success in business, to abstain from the use of intoxicating liquors? Do you consider it to your interest to work to the best of your ability for the interest of your employer, and be economical in the use of fuel and supplies?

A.—This question will be answered according to the judgment of the man under examination.

2. What are the fireman's duties on arrival at engine house previous to going out on a locomotive?

A.—See that the fire is in the condition to make up a proper fire for starting. See that the ash pan is clean. Ascertain that the engine has got on all the necessary tools and supplies, and that the engineer's oil cans are filled.

3. Is it your duty to compare time with your engineer, and should you insist on seeing all train orders?

A.—I should consider it my duty to compare time with the engineer and insist on seeing the train orders, if that was the rule of the company I was working for.

4. Give the substance of the various rules pertaining to signals as found in the Book of Rules and Regulations of the operating department.

A.—This question will be answered by describing the signals described in the book of rules. The meaning of swinging arms and lanterns in different ways must be explained, and also the meaning that the rules attach to the station signals used by the road.

5. In addition to any that you have not mentioned, what else do you consider a danger signal?

A.—Any person near the track violently waving his arms or any sort of light would be regarded as a danger signal; also a fire burning on the track.

6. Explain the principle of the steam gauge.

A.—There are several kinds of steam gauges, but all of them are operated on one of two principles. When internal pressure is applied to a bent flat tube, the tendency of the tube is to straighten out. That tendency is made use of in the Bourdon gauge, the necessary mechanism for operating the dial needle being connected with the tube. The other form of gauge is operated by a double diaphragm of corrugated plate. When pressure is admitted between the plates it forces them outward and the attachments operate the gauge needle.

7. What pressure is indicated by the steam gauge? What is meant by atmospheric pressure?

A.—The pressure above the atmospheric pressure. The pressure of the atmosphere is that imposed by the body of air surrounding the earth. At sea level it is 14.7 pounds to the square inch.

8. What is the source of power in a steam locomotive?

A.—Steam generated by heat.

9. What quantity of water ought to be evaporated in a locomotive boiler to the pound of coal?

A.—From 7 to 10 pounds. It is seldom more than 5 pounds.

10. What is steam, and how is it generated?

A.—The vapor of water. It is generated by the heat from the fuel burning in the fire box.

11. At what temperature does water boil?

A.—At 212 degrees F.

12. What is the temperature of the water in the boiler when the pressure is 200 pounds?

A.—At 200 pounds gauge pressure the temperature of the water is 338 degrees F.

13. What is combustion?

A.—The chemical combination of fuel and oxygen.

14. What is the composition of bituminous coal?

A.—A good quality of bituminous coal contains about 61 per cent. fixed carbon, about 31 per cent. of volatile matter, known as hydro-carbons, 7 per cent. of ash and 1 per cent. of sulphur.

15. What is carbon? From what is oxygen obtained?

A.—Carbon is one of Nature's elements. Nearly all combustible material, such as wood and coal, consists principally of carbon. Oxygen for sustaining combustion is obtained from the air.

16. What per cent. of oxygen is in the atmosphere?

A.—The atmosphere contains 20.63 per cent. of oxygen.

17. Is air necessary for combustion?

A.—It is.

18. About how many cubic feet of air is necessary for the combustion of a pound of coal in a locomotive fire box?

A.—It takes 2.66 pounds of oxygen to burn one pound of coal into carbon dioxide. It takes 4.35 pounds of air to supply one pound of oxygen, therefore it will take 11½ pounds of air to provide the oxygen necessary to burn each pound of coal. As some excess of air is necessary, 20 pounds of air should be admitted to the fire for each pound of coal to be burned, one pound of air fills about 13 cubic feet at ordinary temperatures, so we have 13 x 20 = 260 equal to 260 cubic feet of air needed for every pound of coal burned.

19. How many cubic feet of air, therefore, would be necessary for the burning of a "fire" of four scoopfulls, assuming each scoopful to weigh ten pounds?

A.—For four scoopfuls of coal, each weighing ten pounds, the quantity of air required for combustion would be 40 x 260 = 10,400 cubic feet.

20. Why is it necessary to provide for combustion a supply of air through the fuel in the furnace?

A.—Because it is only by forcing the air through the burning fuel that the proper mixture of the gases will be effected.

GENERAL Questions Answered

CYLINDER LUBRICATION.

(20) F. B. W., Genoa, Neb., asks:

Is it safe to run any considerable distance without allowing a little steam to enter the cylinder to carry lubrication to it in case of derangement of the valve gear and consequent necessity of covering ports? A.—Yes, it is safe. Since no steam or condensation can reach the cylinder when ports are completely covered, there is nothing to destroy the lubrication except the cylinder packing coming in contact with the cylinder wall. If you can run a rocker arm or the forward end of main rod 50 or more miles under pressure with only one application of ordinary engine oil, there ought to b. no danger of cutting of cylinders where a much better grade of oil, valve oil, is always used. On a prominent line where competition is keen and time valuable, a run of 82 miles was made with only one oiling of the cylinder, and no damage resulted. There is less danger of the valve shifting and admitting large quantities of steam to one end of the cylinder with dire results than where the ports are entirely covered.

QUEEN'S VIEW, LOCH TUMMEL, SCOTLAND.

SIZE OF INJECTOR OVERFLOW PIPES.

(21) C. J. V., Osawatomie, Kan., asks:

What size overflow pipe would you recommend for a No. 10 Monitor injector, the injector being located on the boiler head. I have had quite a bit of trouble to get injectors to prime, which I claimed was on account of overflow pipe being too small and too sharp curve in pipe? A.—The overflow pipe connection of a No. 10 locomotive Monitor injector should not be less than 1¼ ins. iron pipe size. It is most likely that the trouble complained of was caused by the overflow pipe being too small, also having sharp curves which prevent the ready clearing of the pipe, and eventually causing the blow back of the steam. For the purpose of preserving the proper size of the overflow piping, and at the same time preventing steam and water from blowing out of the overflow nozzle in the engine cab, the overflow nozzle of the instrument is occasionally fitted with a large diameter pipe which terminates at some convenient point near the track from which water and steam are discharged.

TROUBLE WITH LEAKY FLUES AND STAYBOLTS.

(22) A. A. F., Peoria, Ill., writes:

Suppose the crown bolts show a very bad leak on fire box side, and flues continue to leak very badly, and engine will not run over 8 or 10 hours in switching service after flues have been caulked, and in regular service, flues leaked badly every trip. In such cases I have seen the introduction of some finely divided plaster of paris through the injector stop the leaks. How does it do this? A.—In the cases you mention the water used was probably alkaline; that is, it contained a good deal of the caustic soda or potash, which are substances soluble in water, and when by constant evaporation the water contains an excess quantity of it, the caustic soda and lime falls down as a soft sludge. It will not harden or set up any corrosive action, and tends to keep the joint between flues and flue sheet too clean and open and ready to leak. Plaster of paris is essentially sulphate of lime and is not soluble in water. In this form it has a strong affinity for water, and when wet it "sets" quickly into a hard mass. When introduced into a leaky boiler it is carried with the water leaking out to the ends of the flues and staybolts, where it accumulates in sufficient quantity to "set" hard and so stop the leaks. Great care should be taken as to the amount used, as even a thin layer of this substance on the crown sheet would form a very effective heat resisting medium.

TENDENCY TO SLIP AND SIZE OF WHEEL.

(23) J. C., Quebec, Canada, writes:

Two locomotives of the same class, one having driving wheels 57 ins., and the other 63 ins. in diameter, the weight on the drivers is the same and they each have the same stroke, which engine would slip most? A.—Other things being equal, the engine having the smaller wheel would have the greater tendency to slip. The co-efficient of friction between wheel and rail is for railway service generally taken at 0.2, and this means that a locomotive should be designed so that the tractive effort should be about ⅕ the weight on drivers. If you work out the tractive effort for the two engines you have in mind, assuming all factors to be the same except the size of the wheels, you will find that the one with the smaller wheel will have the greater tractive effort. In this connection read the editorial on the Frictional Limit on page 20 of the January, 1904, issue of RAILWAY AND LOCOMOTIVE ENGINEERING.

SLOPE OF BACK SHEET OF BOILER.

(24) D. G., Dayton, O., asks:

Why is the back sheet of the boiler of some of the latest build of engines made slanting toward the front and what advantage is gained therefrom? A.—The principal reason why some back sheets slop forward is that this arrangement gives more room in the cab and disposes the fire box back sheet so as to cut off what some designers consider to be dead space in the fire box, but the principal reason is the desire for more room in the cab.

HOT CROWN SHEET.

(25) Subscriber, Roanoke, Va., asks:

If water should get below the crown sheet in a boiler, would putting injectors to work be more liable to cause the crown sheet to give way than not to put them to work, and take chances of getting a big fire shaken out of the fire box? A.—Turn to RAILWAY AND LOCOMOTIVE ENGINEERING for March, 1904. page 103, and read the account of some government tests on pumping cold water onto red hot crown sheets, and also read the editorial on boiler explosions, page 116, of the same issue. The experiments there described prove that there is not stored heat enough in a red hot crown sheet to generate sufficient steam to blow up the boiler. There is, however, one other consideration which should not be forgotten. Suppose the crown sheet was dry, but was heated only to the critical or dangerous blue heat and then quickly cooled it might crack or break suddenly. No very reliable information exists concerning this condition.

ROCKER ARM RAKE.

(26) C. W. P., East Syracuse, N. Y., asks:

1. For what reason is the radius or rake, as it is sometimes called, in the rocker arm of a locomotive? I have noticed on some engines that the rake is from ¼ to ½ in., and on some direct valve motion engines it is from 2 to 3 ins. A.—When you speak of "rake" you probably mean that the center lines of both arms of the rocker do not coincide. This is done so that when the rocker is in its central position, each arm will be at right angles to the rod to which it is attached. In the direct motion engines of which you speak, the transmission bar is frequently designed so as to come up over the leading driving axle at a considerable angle, and it is attached to its arm of the rocker placed as nearly as may be at right angles to the direction of motion of the transmission bar as it stands in mid-position, and the valve rod is attached to its arm of the rocker, standing in mid-position at right angles to the horizontal line of movement of the valve rod.

SUSPENSION OF LINK.

2. Why is it that the center of the link block is not in the center of the link? A.—You have not stated your question as we think you mean it. The center of the link and block are on the same line, but the center of the link and that of the link saddle stud do not coincide. In other words, the point of suspension of the link is usually behind the center line of the link, the reason for this we gave in answers to questions contained in the December, 1904, and the January, 1905, issues of RAILWAY AND LOCOMOTIVE ENGINEERING.

REPAIRS TO AIR PUMP.

(27) B. J. R., Los Angeles, Cal., writes:

Reversing rods have both been removed and both pistons have settled down to their lowest positions, and it is found impossible to force piston up by means of reversing rod. How can pistons be gotten to position so rods can be inserted? A.—Block slide valve on low pressure side in its highest position, turn on the steam, and both pistons will move to their highest positions. Then remove oil cups and insert a drift and force pistons down until rods can be inserted.

N. Y. AIR BRAKE PUMP REPAIRS.

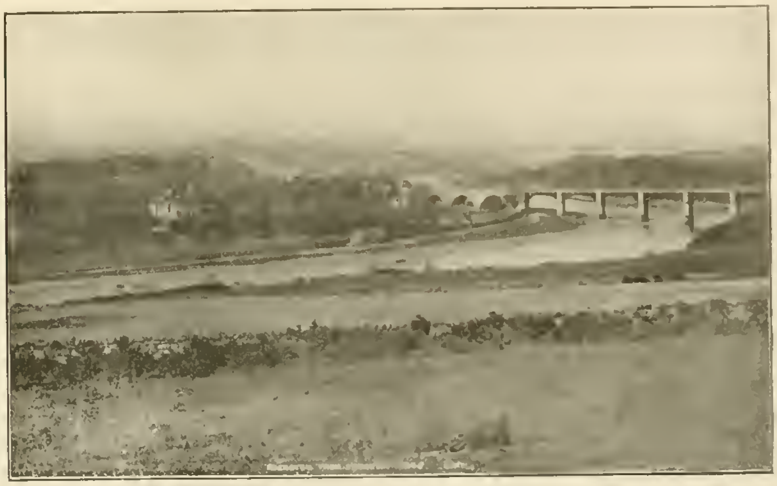
(28) B. J. R., Los Angeles, Cal., asks:

If the reversing rod on the low pressure piston of the New York pump is broken off at the shoulder, and steam has been shut off, and both pistons settled to their lowest positions, how can the reversing rod be removed and a new one inserted? A.—Turn on the steam, and the low pressure piston will move up to the top of its stroke. Then remove the oil cup off the air cylinder and the steam chest cap nut off the steam cylinder of the low pressure side, and insert a drift pin through oil cup opening. Then force the piston down until the defective reversing rod can be removed and a new one inserted.

REPAIRS TO N. Y. AIR PUMP.

(29) B. J. R., Los Angeles, Cal., asks:

If the nuts on the high or low pressure air pistons of the New York pump come off, and assuming that engine has plenty of steam, how can it be arranged so both pistons can be held at their highest position while piston rod nuts are replaced? A.—Remove the reversing valve rod on the high pressure side, replace the slide valve and turn on the steam. Both pistons will then move to their highest positions and stop.



RAILWAY BRIDGE AT ABERDEEN, SCOTLAND.

PISTON VALVE PACKING RING BROKEN.

(30) H. G., Chicago, writes:

Please explain what effect rings 3 or 6, if broken, would have on a Vauclain compound. R. says, if 3 or 6 is broken, it will increase the pressure in the low pressure cylinder. G. says it will not. Which is right? Please explain fully. A.—With valve and chamber bushing a true circle, free from scoring and no broken or cracked bridges, breaking rings 3 or 6 will not increase the pressure. On the contrary, it will have a tendency to decrease the pressure in the low pressure cylinder, and permit the steam to escape past rings 4 and 5 direct to the exhaust, if the latter are not a perfect fit. As an example, should ring 3 be broken and the valve begin to make the rearward stroke, steam in leaving the high pressure cylinder and passing through the hollow valve to the opposite end would at the same time, while entering the low pressure cylinder, try to escape past rings 3 and 4 to the final exhaust. As rings 1, 2, 7 and 8 in good condition would prevent any admission of initial or boiler pressure to the low pressure cylinder, the only possible way for live steam to enter the low pressure cylinder in this instance would be to have either ring 2 or 7 and 8 defective or broken. Any defect in rings 1, 2, 7 and 8 will affect and increase the volume of steam in the low pressure cylinder, while any defect in rings 3, 4, 5 and 6 will decrease the volume, and the tendency is to escape by the route of least resistance, which would be the final exhaust. G. is right.

PISTON VALVE AND CYLINDER PACKING BLOWS.

(31) C. J. V., Ossawatomie, Kan., asks:

1. Kindly give a plan how to locate a piston valve packing and a cylinder packing blow. A.—In making a standing test for piston valve or cylinder packing blows, the same method should be pursued as in testing the ordinary slide valve. In lieu of the flat face on the D-valve, which travels over the valve seat and under ideal conditions forms a perfect joint, regulating the admission and escape of steam to and from the cylinder, the piston valve to accomplish the same result must have expansion rings. Usually there are two of these rings at each end of the valve. With the engine on either quarter, reverse lever in central position, the valve, if in perfect condition, has completely closed communication with the cylinder. If, in admitting steam to the chest with cylinder cocks open, steam should escape from the forward cylinder cock, it would be because the rings at the forward end of the valve were defective; if from the back cylinder cock, it would be the back rings. In testing for cylinder packing, place the engine with the right main pin on the forward top eighth. This brings the left main pin on the upper back eighth, and you can test both sides at the same time, as both valves admit steam to their respective cylinders. Should steam escape from both cylinder cocks with either cylinder, the cylinder so indicating would have either a scored cylinder or defective or broken packing rings. A scored valve bushing, scored valve rings or a cracked or broken bushing would give the same results as a blow in the cylinder packing. In a running test, should a blow occur while the engine is working hard and with the lever down in the extreme forward or back notch, but cease when the lever is cut back, such valve overreaches its valve seat. Should the blow occur while engine is passing either dead center with the lever in any convenient notch, it is the cylinder packing.

2. Why will a piston valve engine sound lame with a broken valve ring? A.—This question does not specify whether it is an inside or outside admission valve. We will, therefore, assume that it is an outside admission and the ring broken is No. 2 at the forward end. As this ring controls the release of steam from the cylinder to the atmosphere, any defect or break in this ring would hasten the release at that point, and the engine would consequently sound lame. If it is an inside admission valve, the same result would be obtained from rings 1 or 4 which control the release, and which of these is broken could be determined by the position of the crosshead when the exhaust took place.

3. Why will a piston valve show no blow while making a standing test, but blow hard at a certain point when engine is working hard and slow? A.—While making standing tests with your ports covered and the valve in perfect condition, there can be no blow. The blow that develops at a certain point when engine is working hard and slow is an indication that the valve overreaches; that is, it travels too far and overlaps the valve seat. Your engine has probably a loose or bent tumbling shaft arm.

Tug-o'-War.

(*Continued from page 70.*)

Jennings, "and ofttimes it is not his fault. Let me take a particular case as an illustration. This morning, at Pigeon Center, the 'Chain Lightning' had to cross over to the west bound track. She was on time, I believe, but her time is so fast that the engineer knew he would be at least ten minutes late before he got around the new steel bridge, across to the east bound track again, and up to speed. He applied his brakes and came down to a safe speed to cross over, then released his brake, as he supposed, and immediately started to use steam, so as to lose as little time as possible. The head brakes, being near the brake valve, were easily reached and went off quickly without trouble. The rear brakes, however, being farther away, and having to be reached through a long length of crooked train pipe, were slower to start, to say nothing about it taking longer to empty those large 14 and 16 inch cylinders of pressure than it took to empty the pressure from those smaller 10 and 12 inch cylinders on the head end. There you are, with a 'Tug-o'-War' set up between the engine, using steam, and the rear brakes, holding back. The result was a break-in-two. A knuckle broke and twenty minutes' time was lost. And that engineer did not create the delay intentionally or knowingly. He is one of our best men, but is regularly assigned to a local run, and has had no experience with long trains equipped with high speed brakes."

"That is a very plain description of your 'Tug-o'-War,' Jennings," observed the G. M.

"But let us hear you apply your 'Tug-o'-War' theory to the case at Hardrock," requested the Genl. Supt.

"This was a coal chute stop and had to be accurately made, and as the engine, the 746, is not equipped with straight air, a stop here without shock or damage is a ticklish proposition. The engineer begun right by making about a twenty-five pounds' reduction, getting full pressure in the brake cylinders and starting the reducing valves to blowing. As he came down to about ten miles per hour he saw he was going to stop a little short of the chute. He threw his brake valve to release for about five seconds, then came back to running position. He felt his slack run out and thought he was going to run by. Then he immediately followed up with a second reduction of about eight pounds, when snap!—and the train was in three pieces. Right off he began cursing the high speed brake—undesired quick action, he thought it was, but he was wrong. It was partly the short time between the release of the first application and the beginning of the second, and partly the poor engine brakes. The head brakes were off, but the rear ones were still on. The leather packings in the driver brake cylinders wouldn't hold shelled corn. I tested them with a gauge just before I came up here, and could only get 45 pounds' pressure in them, and that all leaked off inside of ten seconds. Here was the 'Tug-o'-War'—the rear brakes holding back, and the rotten driver brake—I beg pardon—poor driver brakes letting the heavy engine lunge forward. A knuckle on a sleeping car and a platform on a day coach gave way. Loss of time, 45 minutes. Passengers in the sleepers were just arising at this point, and complained bitterly of the rough stop and the delay."

A smile illuminated the G. M.'s usually stern face. Jennings observed it, and thought to himself: "There's some fun in being general manager—anyhow, more than an air brake inspector gets out of his job." The G. M.'s smile was undoubtedly suggested by a certain incident in connection with the "smash" at Hardrock. In his imagination he could see a stocky, rugged Englishman, completely bald, except for the sandy fringe of hair at the back of the head and over the ears, being "hurled, projectile-like, the entire length of the compahtment, and landing, dripping and swearing, in a very undignified and ludicrous position, mainly on his head—a position vastly unbecoming to an English gentleman, I assuah you."

"That's the time Sir Samuel got hard up against one of our 'abominable' American practices, sure enough," mused the G. M. He quickly sobered, however, and continued:

"I guess we all understand your 'Tug-o'-War,' now, Jennings, and it will not be necessary for you to analyze the third break-in-two of the 'Chain Lightning.' It is similar to the first one on the cross-over at Pigeon Center, is it not?"

"Yes, sir," replied Jennings. "The engineer, finding himself slowed down by the yard master, and anxious to get into his berth track in the train shed without further loss of time to the 'Chain Lightning,' released his brakes at a low speed, the head brakes going off quickly, and the rear brakes releasing slowly, permitting the heavy engine to lunge forward, consequently setting up a 'Tug-o'-War' which broke the long train in two."

"Yes, I thought so," rejoined the G. M. "But Mr. Jones spoke of the Empire State Express running for years with the high speed brake and never having a break-in-two. How was that, Jennings?"

"The Empire State Express, Congressional Limited and those other high speed braked trains spoken of only hauled from three to seven cars. The rear brakes were nearer the engine and felt the effect of the releasing pressure much quicker. The brake cylinders would empty much quicker, also, as there were no 16 in. cylinders then, and no retaining valves and no long retaining valve pipes to retard the discharge of brake cylinder pressure. There was also very little slack in those short trains, and the engines were not so heavy and powerful. In plain words, the 'Tug-o'-War' was not so easy to set up, and the forces playing the game were much smaller. That's the explanation of it."

"And I believe it is all right, too, and a good one," suggested the G. M. "What do you gentlemen think of it?"

"I think Mr. Jennings' explanation sounds reasonable," said Mr. Jones.

The Genl. Supt. could not say anything against it, but would like to see some improvement come out of it.

The S. M. P. advised as follows: "Mr. Jennings should know what he is talking about, for he has been riding for months past with all engineers hauling the 'Chain Lightning' and 'Blue Streak,' instructing them in handling these long trains. We are having very little trouble—say two a month—of this kind, compared with that experienced on one of our neighboring lines, where two break-in-twos a day is not uncommon. The trouble this morning would probably not have happened to the 'Chain Lightning' had Jennings been able to reach the engineer before he went out."

"What would you have said to this engineer, Jennings, if you could have reached him before he went out?" asked the G. M.

"I would have explained the 'Tug-o'-War' to him," replied Jennings, "and told him, when he released brakes, to leave his brake valve handle in full release position, as many seconds as he had cars in the train, before bringing his handle to running position. Also, to never touch his throttle to use steam until after the brake valve handle had been in full release position one second for each car in the train. This would allow his releasing pressure necessary time to reach the rear brakes, and the pressure to empty from the big rear cylinders. No 'Tug-o'-War' could set up then, and there would be no break-in-two."

"But would the engineer take that time? Would he be able to judge, say, fourteen seconds for fourteen cars?" asked the Supt.

"He will come somewhere near it," replied Jennings, "much nearer than if he had not tried at all."

"If we are to wait fourteen seconds to let the brakes off each time they are applied, we will never get our trains over the road," remarked the Genl. Supt.

"Not necessarily so bad as that," rejoined the G. M. "There seems to be more good than bad in the rule, as it now appears to me. Anything more, Jennings?"

"Yes, sir. Friction draft gear ought to be applied to all our cars and engines in this long, heavy train service. The ordinary draft gear springs compress solid before the tractive effort of the engine is half reached, and a dead, disruptive strain is then thrown on the coupling connections and car underframes. The same strain happens during brake release at low speeds, and usually a knuckle lets go. Again, these springs, after compression, recoil and kick back, causing a surging and jerking throughout the train, sometimes breaking it in two. Besides the 'Tug-o'-War' there is a sort of 'Crack-the-Whip' game set up—a bad combination—something like a stable full of young mules, tugging on their halters and kicking up their heels. There's something doing. Friction draft gear has much greater capacity than the spring gear; but greatest of all, it absorbs and annuls the shock instead of collecting it and setting up the combination game of 'Tug-o'-War' and 'Crack-the-Whip on a long, heavy passenger train. It would nearly eliminate break-in-twos and would pay for itself in two months' time."

"Possibly the rebate on those 'Chain Lightning' tickets this morning would equip the train. Anything else?"

"Yes, sir. Straight air ought to be

A SIXTEEN HORSE POWER MOTOR MOVING FREIGHT ON THE PRAIRIE.

put on all our heavy engines, to hold in the slack at these accurate stops at slow speeds, instead of using all the train brakes. That will lessen our break-in-twos, also."

"Anything else?"

"Yes, sir. We should have more help in the roundhouse to test and maintain our engine brakes. They are not—very poor, sir, and contribute surprisingly to our break-in-twos."

"Anything else?"

"Yes, sir. We should have more main reservoir capacity on our engines and better piping arrangement to deposit the water in the main reservoir and keep it out of the triple valves. No lubricant will stay on the slide valves where moisture is allowed to wash it off and cause undesired quick action. This is causing a good many of our break-in-twos."

"Anything else?"

"Yes, sir. We ought to have the latest triple valve testing benches, where the valve K will detect 'kickers.' Our present machines won't do this. We also ought to have one of these latest devices so rigged up that our long trains, before going out, can be tested as a whole for service application and release, the same as our triple is tested in the shop."

"Anything else?"

"Nothing more, sir."

"Then you may retire. But keep up the good work. Drill the 'Tug-o'-War' into every man on the line, and stop these delays to the 'Chain Lightning' and 'Blue Streak.' You may go."

"Gentlemen," spoke the G. M., addressing the occupants of the leather cushioned chairs, "that young fellow, Jennings, knows his business. Moreover, he *knows that he knows* it, else he could not have held up his end so well. He is dead onto these things and has been for some time past. Doubtless, he has saved us many a delay to the 'Chain Lightning' and 'Blue Streak' that we know nothing of, and therefore give him no credit."

"I would like to say a word for Jennings," said Mr. Burns, the S. M. P. "When we began equipping with high speed brakes, Mr. Jennings scouted around among our neighbors, learning all the troubles they were having, and proceeded to provide against them. The result is that we are having one break-in-two where they are having ten or twenty. His 'Tug-o'-War' scheme has done the work."

"I believe it—all of it," replied the G. M. "And now, gentlemen, I want each one of you to give Jennings your staunch support. He seems to be an efficient, reliable and worthy fellow, and one who warrants our co-operation. Good-morning, gentlemen."

As they passed outward through the green swinging door, the G. M. thought hard: "The more I see of this air brake business, the more I am convinced that it is a department of railroad economy that is vastly underrated and overlooked, and if properly supported will relieve us of many of our most serious and expensive troubles. Think of it!—refunding the rebates on those 'Chain Lightning' tickets this morning, and all on account of the 'Tug-o'-War.'"

Air Brake Department.

CONDUCTED BY F. M. NELLIS.

Arrangement of Piping and Main Reservoirs to Prevent Water in Brake System.

The absence of any recent contributions to railway magazines and journals

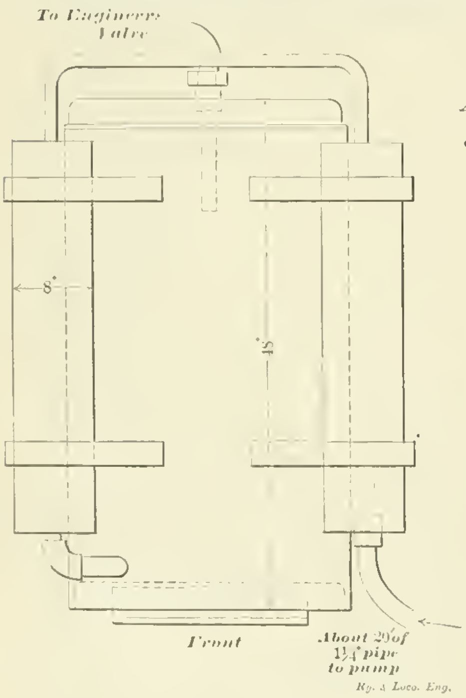


FIG. 1.

on the subject of water in the train pipe of locomotives and tenders would seem to indicate that trouble from this source, which has been so prominent heretofore, is either a thing of the past, or those who are familiar with such matters are keeping quiet on the subject. The latter case is the most probable of the two in question.

Committees of the Air Brake Association have demonstrated, by elaborate practical tests, that a system of reservoirs and piping which will insure cooling the air to atmospheric temperature before it leaves the main reservoir, will reduce frozen train lines to a minimum. It has also been demonstrated, both in service and by tests, that if the temperature of the air is reduced to freezing point while under constant pressure, frost will accumulate on the inner walls of the storage reservoir or piping in which the cooling is done. Owing to the large area of the reservoir, the former would cause no trouble; but, in the latter case, the orifice of the pipe will become closed if the temperature of the air remains below freezing point for any considerable period.

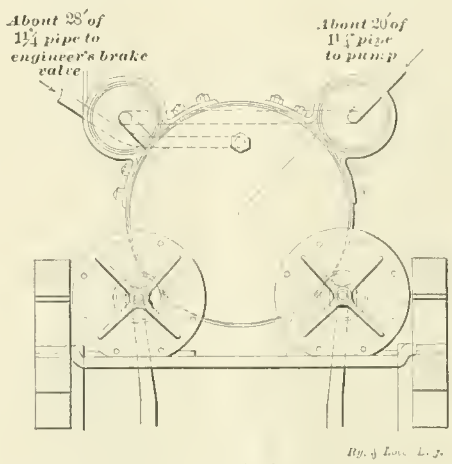


FIG. 2.

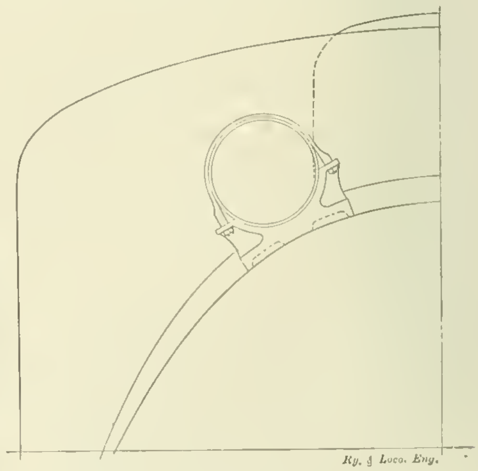


FIG. 3.

The writer's past few years experience with over 500 locomotives and air pumps of various types employed in almost every imaginable class of service, and where the variations in temperature and climatic conditions would compare favorably with almost any section of the country, has led to the conclusion that there can be no fixed rule for piping engines and arranging reservoirs which would insure desirable results in all classes of service and weather conditions, but that the arrangement must be made to suit the peculiar local conditions surrounding the case.

Figs. 1 and 2 show a system of piping that has been in service on some of the Central Railroad of New Jersey high speed passenger engines for two winters. The 1¼ in. discharge pipe was formerly about 5 ft. long and connected to the main reservoir, adjacent to the engineer's brake valve connection, with the result that the angle cock at the back of the tender frequently froze solid more than once during a trip. Since lengthening the discharge pipe to about 20 ft. and adding the two pieces of 8 in. pipe, as shown on the drawing, for cooling service between the pump and reservoir. there has not been a case of frozen train line on an engine of this class; nor has a discharge pipe ever frozen at any point between the air pump and the entrance to the large main reservoir. While this system has eliminated the freezing of train line connections, moisture is deposited in the brake mechanism, but not in sufficient quantity to cause air-brake failures, and the system is not considered as desirable as the ones illustrated in Figs. 3 to 7, wherein two main reservoirs are shown.

Figs. 3, 4 and 5 are drawings of a system for reservoirs, piping, etc., that has been found very desirable for wide fire box engines. The reservoirs are out of the way of the engineer and engine inspector, which in itself is of considerable importance. The results obtained from the use of this system in both freight and passenger service have been most excellent. The piping between the pump and first reservoir is about 28 ft. long. The two reservoirs are connected at the back by means of about four foot of 1¼ in. pipe. The freight engines equipped in this manner are operated over one to two per cent. grades, handling 50 to 75 car trains with air brakes coupled and working on all cars in the train.

During the present winter the engines have also been equipped with the Westinghouse Air Brake Company's high pressure control and 11 in. pump, working against 110 lbs. main reservoir pressure. A smaller pump was used in previous winters which, owing to the high reservoir pressure pumped against, and the heavy mountain service, naturally delivered the air at a high initial temperature. It is interesting to state that there has never been a case of frozen air pipes or any part of the brake mechanism on these engines, notwithstanding the temperature of the atmosphere has ranged anywhere from the freezing point to 15 degrees below zero. At one time, frozen train pipes in this service, with a different system of reservoirs and piping, was a daily occurrence. If, however, the discharge pipe did not pass through the engineer's cab, it would probably freeze at the reservoir connection in extremely cold weather and light train service.

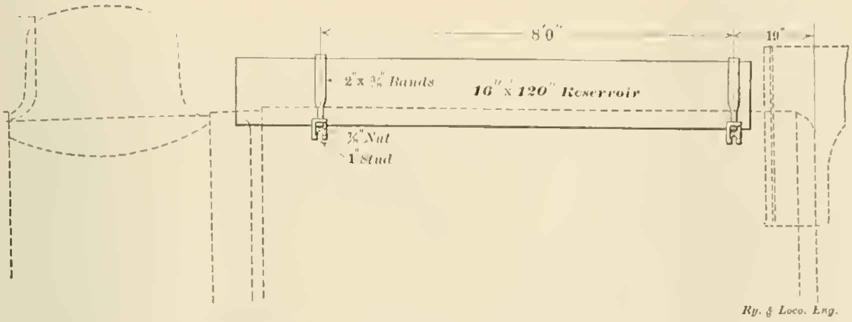


FIG. 4. RESERVOIRS ON TOP OF BOILER, WIDE FIRE BOX.

The same system of reservoirs and piping is employed on heavy passenger engines operating in high speed train service between Jersey City and Philadelphia, handling from three to twelve car trains, where climatic conditions are quite different from that in mountain service. The passenger engines were formerly equipped with one large reservoir located at the back of the tender, with about 35 ft. of pipe between the pump and main reservoir. The train pipe was never known to freeze with the old or revised system, but the discharge pipe would freeze solid under the old method after the engines had made about 300 miles, which has been overcome by shortening the pipe and substituting two 16 x 120 in. reservoirs for one larger one. The fact that this system has precluded train pipe freezing in freight service, and has proven to be equally as serviceable for high speed passenger trains, where trouble formerly existed. it would seem to be about the proper thing for all engines on which reservoirs can be located, similar to the method shown in Figs. 3, 4 and 5.

Since adopting this method for use on all wide fire box engines, 18½ x 120 in. reservoirs have been substituted for 16 x 120 in. on engines in heavy freight service, the larger main reservoir volume having been found desirable in handling long trains. It is not believed that the increased diameter of the reservoirs will materially effect precipitation.

Figs. 6 and 7 are drawings of a method of piping and location of reservoirs which has given most excellent results in heavy freight and coal service, where from 50 to 75 cars are handled on one train. About 28 ft. of 1½ in. pipe is used between the pump and first reservoir, and, as will be noted, is free from sharp bends and right angle fittings. The discharge pipe connection at the first reservoir has a nipple on the inside of the drum pointing downward, so as to turn the current away from the connection leading to the second reservoir. About 7 ft. of 1¼ in. pipe is used between the two air drums. The brake valve connection is made in a manner that prevents moisture being drawn from the reservoir by the current of air passing through the reservoir. This method of piping is not considered preferable to that shown in Figs. 3, 4 and 5, but was resorted to as the most economical substitute for a system that formerly gave a great deal of trouble. It will

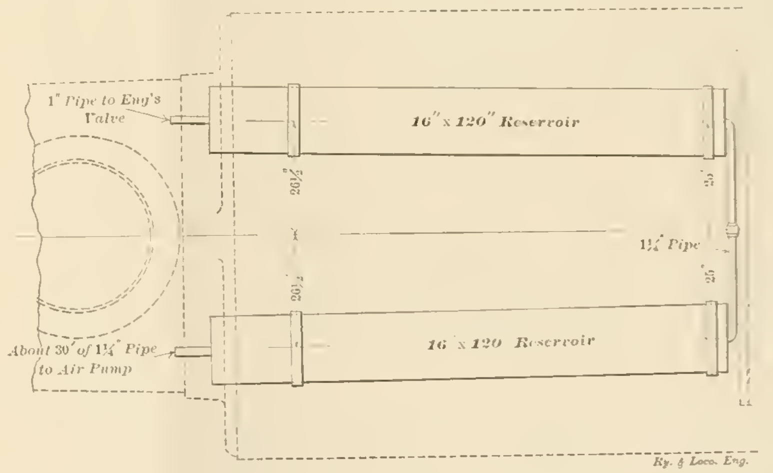


FIG. 5. PLAN VIEW OF RESERVOIRS ON TOP OF BOILER, WIDE FIRE BOX.

also be found very desirable in cases where it would not be practicable to locate the reservoirs under the boiler.

It is the writer's opinion that wherever two main reservoirs are used, at least one of them should not be larger than

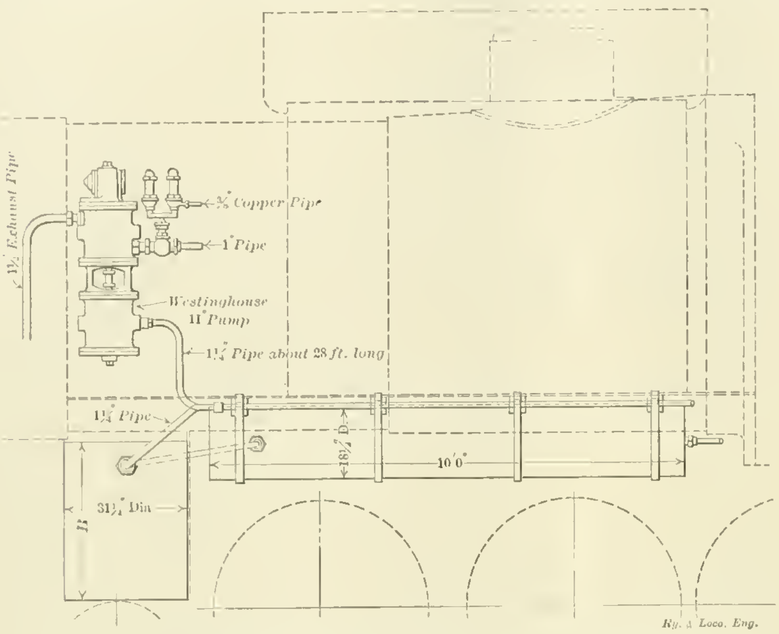


FIG. 6. ARRANGEMENT OF RADIATING PIPE TO DEPOSIT MOISTURE IN MAIN RESERVOIR, KEEPING IT OUT OF TRAIN PIPE.

20½ in. in diameter, providing the same can be made 8 to 10 ft. long, and the discharge pipe leading to the first reservoir should be from 18 to 28 ft. long, as local conditions may require, which will insure very desirable results for almost any class of service. It is also believed that the elimination of sharp bends and fittings in discharge pipes will enable the use of a much shorter pipe with better results than would be obtained from the use of a long pipe containing a number of ells and return bends, etc. T. L. BURTON.

New York City.

Speed of Air Pumps.

I will respond to Mr. A. L. Jennings' request in the January issue, that others reply regarding reduced air pump failures by similar or other means than that used by Mr. Langan, Lackawanna Railroad.

Two years ago I experimented with reducers in the steam pipe to air pump, and found that a 1/16 in. copper diaphragm with an exact ½ in. hole for steam to pass, would run a 9½ in. pump at about the following speeds when the pump was working against 70 lbs. of air:

Steam Pressure.	Air Pressure.	Strokes per Minute.
200	70	160
190	70	154
180	70	148
170	70	141
160	70	135
150	70	129

Since these tests were made, this company has adopted the ½ in. reducer placed at throttle joint, on all engines carrying over 140 lbs. of steam. Our air pump failures have reduced materially, and pumps last much longer with better service. Where trains cannot be charged, we go after the train leakage.

Since using soap-suds on all cars passing repair tracks, and removing spongy air hose, and repairing leaky joints, our failure to get full air pressure is less common.

Where an air pump has to be worked to its full capacity all the time to furnish

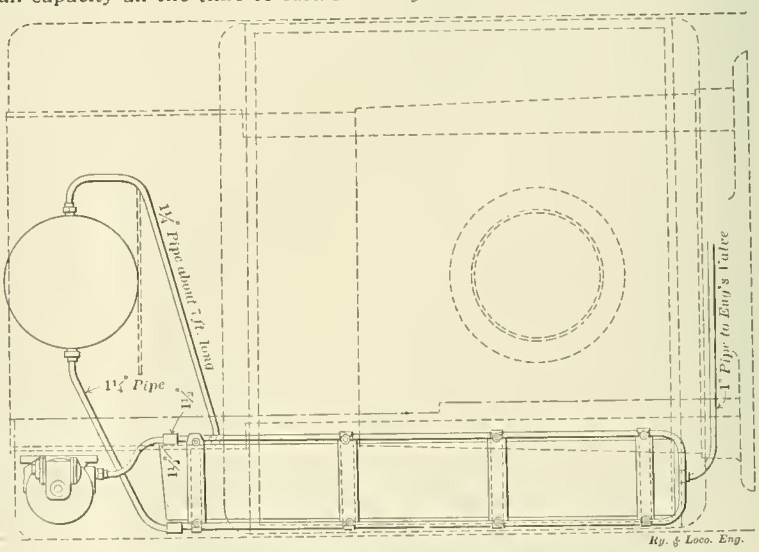


FIG. 7. RADIATING PIPE TO COOL THE AIR AND PRECIPITATE THE MOISTURE IN THE MAIN RESERVOIR.

sufficient air for braking purposes, it is time to interest the car end of the air-brake business. Under such conditions of leakage it is difficult to make the best of stops, to say nothing about the difficult release.

If the pump begins to show debility, repairs should be made, rather than run the pump at a break-neck speed to stay in business, and later on have it fail at a critical time.

Reduced pump speed is the proper thing; and Mr. Langan is favored if he can get all enginemen to confine themselves to the 140 stroke rule. The reducer, however, does the business sure.

One road has a ⅝ in. reducer on engines with 140 to 160 lbs. steam; a 9/16 in. reducer on engines with 160 to 180 lbs. steam; a ½ in. reducer on engines with 180 lbs. steam or over.

A certain western road with few failures has a ¾ in. steam pipe for 9½ in. pumps, and a ½ in. steam pipe for 8 in. pumps.

Another road placed two 9½ in. pumps on 60 some engines to guard against failure by having one pump left. Since the application of two pumps, each run moderately, neither pump failed. Mr. Langan is right. May others follow; then we will all have better air-brake service.

L. M. CARLTON, Gen. A. B. Insp'r,
Chicago & North Western Ry.

Chicago, Ill.

The Coming Air Brake Convention.

The Twelfth Annual Convention of the Air Brake Association will be held in New Orleans, La., beginning Tuesday, April 11. The new St. Charles Hotel has been selected for Convention headquarters. The convention will open at 9 A. M. with President John Hume, Jr., in the chair. It is expected that this meeting will prove equally as interesting and instructive as have the proceedings of the eleven preceding conventions, all of which have gone down in history as important advances in the air brake art.

A South African Goods Wagon.

The steel car which we here illustrate is not called a gondola on the Central South African Railways where it is used. In the "Dark Continent" it is known as a goods wagon, and at the time it was photographed it had on its side sill the initials of the Imperial Military Railways. The wagon was built by the Lancaster Railway Carriage & Wagon Company, Ltd., of Lancaster, Eng., and the data concerning it was kindly furnished to us by Mr. Philip A. Hyde, Chief Locomotive Superintendent of the railway, whose headquarters are in Pretoria.


STEEL GOODS WAGON ON THE CENTRAL SOUTH AFRICAN RAILWAY.

The steel goods wagon weighs light 30,268 lbs. and it is expected to carry a load of about 70,000 lbs., which will give a gross load of over 100,000 lbs. The length of the body inside is 37 ft. ⅝ in.; width, 7 ft. 9 ins.; depth at sides, 3 ft. 8 ins. The wheels are 33½ ins. in diameter, steel tired. The journals are 9x4½ ins. From truck center to truck center is 24 ft.

The car is built of structural steel shapes and is an example of very neat and compact design. There are only two truss rods used and they are riveted to the side sills in the third panel from the ends, and the requisite tension is got by two turn-buckles on each placed near the center of the car. The queen posts are three to each truss rod, and the posts are firmly braced, each by two struts, which are placed parallel to the length or across the car.

The trucks are made out of plate steel and the axle boxes are entirely outside of the truck sides. The springs are semi-eliptic and book-shaped hangers rest upon their ends. The hangers are riveted to the truck sides with counter-sunk rivets, thus giving a smooth appearance. The whole arrangement permits the floor of the car to be as low as possible, and the illustration shows that there is probably only sufficient wheel clearance between under side of the floor and wheel flange.

The side doors are made somewhat shorter than the car sides, so that when the doors open they will hang clear of the roadway. A loose wooden filler on top makes up the shortage of the door on each side. A pair of springs extending down from the side sills take up the shock when the doors slam open and hold them away from the truss rods, turn buckles, etc.

The ends of the car indicate the shape of the load when it has been carefully placed covered with canvas and roped down. Cleats for fastening these ropes may be seen along the sides of the car, one in every alternate panel and one next the door. On each side of the door a casting is riveted on, and through this the end of a cross brace is seen, tightened up with a nut. These braces can be removed when the car is being loaded or unloaded. Link and pin drawbars are used and the whole make of the car indicates that it is not intended for, nor does it receive, the rough handling that it would on any American road.

Safety Appliance Law Valid.

A decision has been made in the case of Johnson vs. the Southern Pacific Railway Company, the Supreme Court of the United States practically held that all cars, including locomotives, should be equipped with uniform automatic couplers. The court also held that dining cars cannot be exempt from the requirements of the safety appliance law when in use even though empty.

The decision is considered by the interstate commerce commission and the department of justice to be a decided step forward in the protection of railroad employees. Secretary Moseley of the commission summaries the points decided as follows:

"First, that couplers on railroad cars must be of such a character that they will couple automatically and so save employees from going between cars, though absolute uniformity is not required.

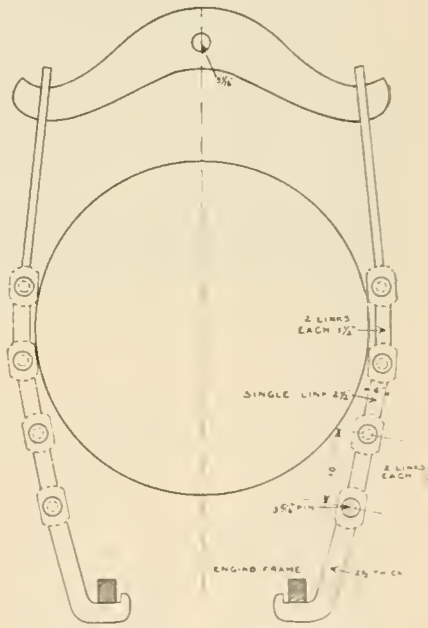
"Second, a car though empty and on a side track may be engaged in interstate commerce.

"Third, that for the purposes of the safety appliance law locomotives are cars and they are required to be equipped with automatic couplers."

Apparatus for Lifting Front Ends of Locomotives.

The chain by which they lift locomotives at the Rogers Locomotive Works, at Paterson, N. J., is shown in our line engraving. It is a very substantial affair, as one can see by examining the dimensions given. The chain, or, rather, series of links and hangers which we show, is used at the smoke box end.

A heavy curved cross bar, with a 5 1/16 in. hole, hangs from what one may call the grab hook of one of the two electric overhead cranes used in the erecting shop, and from either end of this, there is a link about 3 ft. 8 ins. long, which terminates in an eye which takes a $3\frac{5}{8}$ in. pin. From this pin, two links, each 1½ in. thick, 4 ins. wide and 18 ins. long, hang. Another $3\frac{5}{8}$ in. pin secures a single link 2½ ins. thick and 18 ins. long and from this same sized pin again depend two links 18 ins. long, each 1½ ins. thick, and from the connecting pin of these, there is on each side a hook-shaped piece 2½ ins. thick, which passes under the frame front and so "grasps" the front end securely.



FRONT END LINK CHAIN FOR LIFTING LOCOMOTIVES.

The whole arrangement is strong and flexible and, one may say, durable, because if the engine to be lifted happened to be hot, no detriment to the "chain" would take place, as is so often apparent when a sling rope is used. This rig is a permanent shop appliance that never grows old and does not wear out, and in this respect it resembles the Deacon's wonderful "One hoss shay," as described by Oliver Wendall Holmes. When not in use it hangs quietly and modestly from a suitable bracket on the shop wall and is "always ready for business, though not looking for the same," as the captain of the Wayofftown fire brigade said when called upon for a speech in reply to the toast of "Our Fire Fighters."

A Northern Pacific 4-6-2.

The Schenectady shops of the American Locomotive Company have recently been called upon to furnish the Northern Pacific Railway with some simple 22x26 in. engines with 69 in. driving wheels. The wheel arrangement makes them 4-6-2 or Pacific type engines, and they weigh in working order 21,900 lbs. and have a calculated tractive power of about 31,000 lbs.

V an Alstyne, Mech Supt — NORTHERN PACIFIC 4-6-2 ENGINE. — American Loco. Co., Builders.

The wheels are all flanged and the main driver is the middle pair. The driving wheels and the carrying wheels at the back are all equalized together with well jointed gear. Overhung semi-elliptic springs are used, composed each of 16 plates 4x7/16 ins. The main valves are of the piston type, driven by direct motion. The crosshead is lipped up under the notched edge of the upper guide bars, and the yoke grasps the guides almost midway between the ends.

The pedestal binders are made to surround the ends of jaws and a wedge at each end draws the binder tight against what acts as a spacing piece in the center. There is a lug on the under side of the binder through which the wedge bolt is tapped, and when the nuts are slacked off the wedge can be raised or lowered by turning the wedge bolt, thus a sure motion can be given to the wedge at any time.

The boiler is of the extension wagon top type, but the taper course is the second one and carries the dome. This is really a conical course, as the boiler tapers up as much on the under side as it does on top. The diameter at the smoke box end is 72⅛ ins. and the third sheet measures 84 ins. outside diameter. The heating surface is as follows: Tubes, 3,339.4 sq. ft.; fire box, 182 sq. ft., and the brick arch tubes give 6.8 sq. ft. The total heating surface is therefore 3,528.2 sq. ft.

In looking at our illustration it will be apparent that the boiler is quite long. The tubes measure 18 ft. 6 ins. between flue sheets, and there are 347 of them. The front flue sheet is 14 ins. back of what shows in our illustration as the smoke box seam, and therefore the smoke box is that much longer than it looks.

The tender has a water bottom and the tank will hold 6,000 U. S. gallons of water and 12 tons of coal. The underframe is made of 13-in. steel channels, and the tender trucks have semi-elliptic springs with equalizers, and the axle boxes work in jaws. The wheels used in the engine and tender trucks are Boise plate wheels. A few of the leading dimensions are as follows:

Wheel base—Driving, 12 ft.; total, 33 ft.; wheel base, total, engine and tender, 61 ft. 11 ins.; weight, in working order, 219,000 lbs.; on drivers, 142,500 lbs.; weight in working order, engine and tender, 347,800 lbs.

Grate area, 43.5 ins.

Axles—Driving journals, main, 9½x12 ins.; others, 9x12 ins.; engine truck journals, diameter, 6 ins.; length, 11 ins.; trailing truck journals, diameter, 8 ins.; length, 14 ins.; tender truck journals, diameter, 5½ ins.; length, 10 ins.

Boiler—Working pressure, 200 lbs.

Firebox—Type, wide; length, 96 ins.; width, 65¼ ins.; thickness of crown, ⅜ in.; tube, ⅝ in.; sides, ⅜ in.; back, ⅜ in.; water space, front, 4½ ins.; sides, 4 ins.; back, 4 ins.

Trailing truck—Radial, with outside journals.

Piston valve—Travel, 6 ins.; steam lap, 1 in.

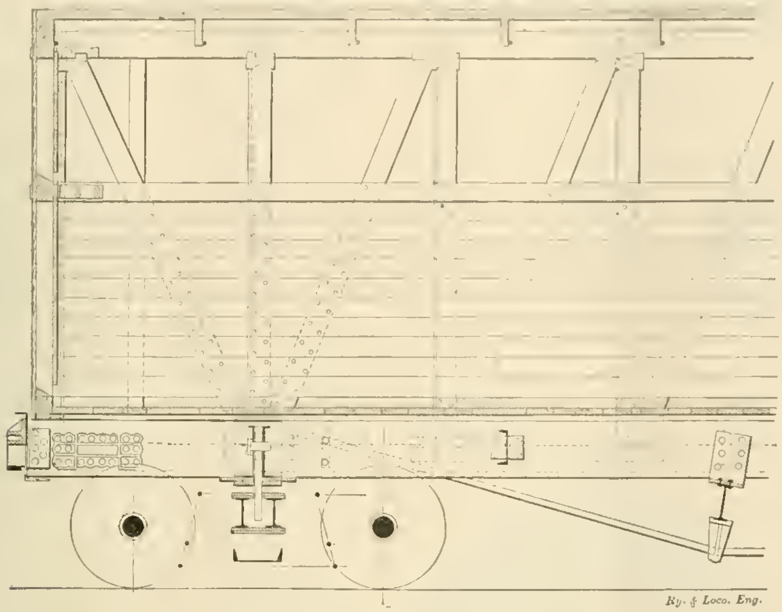
Exhaust—⅛ in. clearance.

Setting—Line and line forward, 7/32 in. blind; back motion, ¼ in. lead at 6½ in. cut-off.

Smoke Box Heat Insufficient.

The smoke box of a locomotive is generally considered to be pretty hot, and you would probably find it so if you were sitting close beside it on a fine day in early August, taking indicator diagrams, as the heavily loaded engine crawled slowly up grade, giving you with late cut-off, regular "gold brick" cards. That smoke box heat does not amount to much on a January night, as far as keeping a man warm is concerned, was discovered by a young fellow who climbed onto the front footplate and got in under the extension smoke box of a fast express on the N. Y. C., and rode there from Syracuse to Rochester last month. Out of work, he left Philadelphia, intending to dead-head the trip to Buffalo.

On arrival of the train at the Rochester station in the morning, a policeman noticed a black object nearly covered with snow on the front of the engine. Investigation revealed the fact that it was the body of a youth of 18, in a state of semi-collapse. When taken to the police station he could not stand. His face, ears and hands were frozen, and his clothing had to be cut off from his body. A dark purple hue suffused his skin and showed that very little more in the way of exposure would have ended his life. As it was, only for the friendly drift piled up on the pilot, and which threw a blanket of snow around him, he would have been quickly frozen stiff in one of the long, steady, tireless, hard runs which the



BOX CAR WITH STEEL UNDERFRAME.

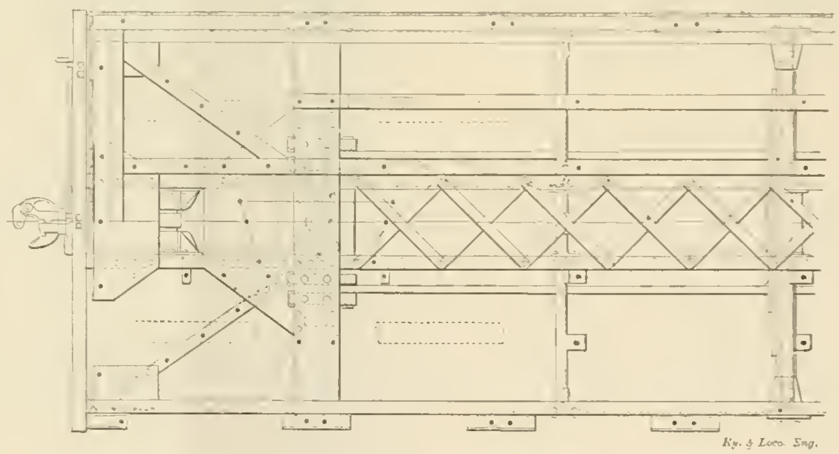
night mail makes against time, and in the teeth of a winter gale.

Box Car with Steel Underframe.

A good example of a wooden box car with steel underframe is here illustrated. It was built by the Middletown Car Works, of Middletown, Pa., of which Mr. Geo. I. King is vice-president and general manager. The car is 40 ft. long and has a capacity of 110,000 pounds. It was built for the Illinois River Packet Company and is used for the carriage of wheat, corn and other cereals. For this reason the superstructure was made unusually heavy and long. The other dimensions conform to the American Railway Association Standard.

The underframe is made of structural steel, the principal members being channels. These are the two center and the two outside sills, they are 15 ins. deep and weigh 33 pounds to the foot. The center sills are 18 ins. apart with the flanges turned outward and so placed that the top strap of the body bolster passes over them. The arrangement of the center sills and the material of which they are composed, readily permit the placing of the coupler in the direct line of the pull, which was not possible with the wooden form of construction where provision had to be made for the constant renewal of draw timbers and gear. Between body bolsters, the center sills are tied together by a series of diagonal straps riveted on to form a kind of lattice work bracing.

The end construction of the frame is very substantial. The center sills are united at the body bolster by a plate extending along the top of bolster 32 ins. from the center in each direction and tapering to 18 ins., where it joins the center sills and covering them for a distance of about 24 ins. Another smaller but similar plate unites center and end sills. The corners of the car are braced by two diagonal struts which are riveted to corner plates and to the large plate which holds bolster and center sills in place. The end sills and the outside sills are fastened together by an-



PLAN OF STEEL UNDERFRAME.

gles in the usual way. The whole arrangement makes a very rigid structure capable of resisting considerable horizontal pressure.

The body bolster consists of a wide flat top member and a heavy lower plate stretching from the upper corner of the outside sills to below the center channels. This lower or diagonal plate is reinforced with angle irons and braced from the center line of the side bearings to the under side of the center sill. Two plate fillers are riveted between the center sills over the front and back edges of each center plate, so that above the center plate sills and bolster form a what may be likened to a steel box.

There are two very heavy truss rods which run fore and aft under the car. They are pinned at each end to two eyes which are riveted to the top plate of the body bolster. A heavy turn buckle produces the requisite tension in the rod and the queen posts on the needle beams are placed at such an angle as enables them to squarely take the upthrust of the rod at the point where it bends away from horizontal.

The car has been designed with great care, and rigidity of construction combined with minimum number of parts and accessibility thereto have been the ends sought. We are informed that the owners have experienced great satisfaction in the use of these cars.

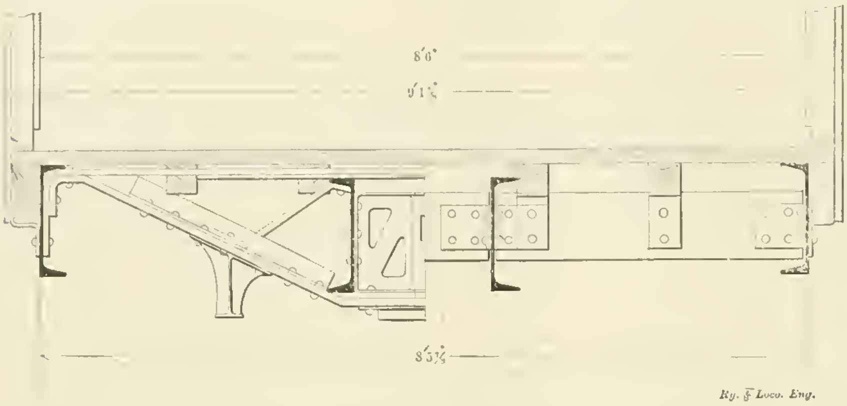
Westinghouse Steam Turbines.

An interesting feature of the recently announced developments in the Baltimore Electric Power Enterprise is the exclusive adoption of steam turbines as the prime mover. A contract recently closed with the Westinghouse Machine Company provides an initial equipment of 4,000 kw. in two generating units of 2,000 kw. each. A Westinghouse electrical equipment, complete and modern in every particular, has also been contracted for.

Officers of the company state that the power plant will embody the latest developments in steam and electrical engineering. The building is to be of fireproof construction throughout, the structural steel frame also serving as supports for the boilers and the overhead coal bunkers. Being located outside of the congested districts of the city, all the boilers and heavy machinery will be on the ground floor. Floors and roofs will be of steel concrete construction.

The steam turbine plant will operate

with a boiler pressure of 175 lbs. and a superheat of about 100 degrees F. A high vacuum condensing system will be installed, capable of sustaining a vacuum of 28 ins. at full load on the plant. The plant in its entirety has been designed on the separate unit plan, which virtually consists of a number of distinct power plants placed side by side, each entirely separate from the other, but



END VIEW OF STEEL FRAME OF CAR.

each capable of helping out the other in case any link in the system should be disabled. This holds good through the coal-handling apparatus, the boilers, steam piping, turbines, condensers, generators, switchboard, underground cable, etc., from the coal pile to the customer's building. In addition to this precaution against interruption of service which is thus insured, the company will install a large storage battery which will ordinarily "float" on the system. The construction work is already under way and will be pushed as rapidly as possible, in order that the plant may be complete in all respects and running smoothly by July next.

Alcohol, Taffy and Steam.

A story is told of one of the early railroads tried in China, having been pushed out of business through a mistake of filling the tank of a locomotive with alcohol instead of with water. When steam was got up from the alcohol, the engine performed such crazy freaks that it frightened all the celestials out of their wits, and the railway was abandoned because the foreign devils had shown themselves more reckless than usual.

A mistake with almost as ludicrous effects happened on a division of the Baltimore & Ohio Railroad last month. The company were short of water and had to convey a supply by means of a water train, and the Italians who emptied the water into the stationary tank put in a load of molasses in mistake. Taffy was immediately at a discount, but it was found out of place inside of a locomotive boiler, and, after a short time, stopped the process of steam making. The consequence was that several locomotives were laid up until the taffy could be broken off their heating surfaces.

Paying Fare on Size.

American inventors may be depended upon to keep well advanced with all conveniences necessary for our advancing civilization. We have lately heard of one inventor who offers to railroad people an apparatus that will weigh and measure people. He argues that passengers ought to be charged fare according to their weight and the space they occupy in a car. The idea is a little premature but it may come to that.

Something of the kind is already in use on some railways. A correspondent of the Louisville *Courier-Journal* makes the following notes of travel:

"When we reached Switzerland," said the tourist, "we found in the railway stations, alongside of the ticket office, machines for measuring the height of children. I said to the agent at Geneva:

"'A half ticket for my little girl.'

'Isn't she too tall?' the man asked. 'Let her step on the measurer, please.'

"'My daughter's height was duly taken. It was four feet five.

"'All right,' said the agent. 'She passes after all.'

"Then the man explained to me that on account of innumerable disputes over the age of children half fares were now sold in Switzerland according to height instead of according to age. Children under three feet traveled free. Those between three feet and four feet six paid half fare. Those over four feet six paid full fare.

"'The new rule is a good one,' said the agent. 'We have no more disputes. The children are measured at the ticket office, and that is the end of the matter.'"

The Mono-Rail in our Midst.

A mono-rail project has been brought out by a Baltimore man, and press dispatches state that work is being started in the construction of an experimental one-rail line five miles long in the neighborhood of the Monumental City.

In this system the weight bearing T-rail is spiked to the ties in the usual manner, and the car is held in an upright position by means of two angle-iron guide rails overhead, on which run overhead trucks fastened to the roof of the car.

When everything is in place it will be practically impossible to remove the car from the track or from beneath the structure without taking parts of the car or the structure apart. The trucks are provided with springs which enable them to adapt themselves to inequalities or irregularities of the trolley bars, as the overhead angle-irons may be called.

ON THE PARIS, LYONS AND MEDITERRANEAN, NEAR MONTE CARLO.

Of Personal Interest.

Mr. W. L. Kellogg, master mechanic of the Missouri Pacific Railway at Fort Scott, Kan., has resigned his position to become superintendent of machinery of the Pere Marquette Railway, with headquarters at Grand Rapids, Mich. Mr. Kellogg began railroad work as apprentice on the Missouri Pacific Railway, July, 1886, but left that company in August, 1890, to take a position as fireman on the C., St. P. M & O. Ry., then a part of the North Western system, where he was promoted to be engineer and traveling engineer; leaving the Omaha road he became road foreman of engines on the Iron Mountain, in November of 1901. From this position he was promoted to that of master mechanic at Fort Scott, Kansas, August 1, 1902. Mr. Kellogg is one of the brightest men in the mechanical department in this country and his many friends wish him success in his new field of labor.

Mr. W. C. Smith, formerly roundhouse foreman and general foreman at Hoisington, Kansas, has been appointed Master Mechanic of the Southern Kansas Division of the Missouri Pacific Railway, with headquarters at Fort Scott, Kansas, vice Mr. W. L. Kellogg, resigned.

Mr. William H. Keffer has been appointed assistant to the general superintendent of the Philadelphia & Reading Railway, with office at Reading, Pa.

Mr. L. O. Genest has been appointed general storekeeper of the Canadian Pacific Railway for lines west of Port Arthur, with office in Winnepeg, vice Mr. W. H. Kelson resigned.

Mr. J. R. Callaghan has been appointed general storekeeper of the Canadian Pacific Railway for lines east of Port Arthur, with headquarters in Montreal, vice Mr. W. H. Kelson resigned.

Mr. C. M. Weathers has been appointed acting road foreman of engines on the First Division of the Atlantic Coast Line Railroad, with headquarters at Wilmington, N. C., vice Mr. R. R. Young promoted.

Mr. R. R. Young has been appointed master mechanic at the Waycross shops of the Atlantic Coast Line Railroad, with jurisdiction over the Thomasville and Brunswick & Western Districts, vice W. H. Dyer resigned.

Mr. F. A. Deckert has been appointed master mechanic at the Riverside shops of the Louisville & Nashville Railroad at Knoxville, Tenn.

From trackman to superintendent the men of the Long Island Railway are rejoicing that Mr. William F. Potter has been elected the president of that road. Mr. Potter has been general superintendent of the road since 1897, and as the man holding that position comes in more intimate contact with all employees than any other official, they have learned to appreciate his worth in fair dealing and in appreciation of honest service. Mr. Potter is a born railway man and there is nothing about the business that he does not understand from personal contact. He began work when 20 years old in the auditor's office of the Flint & Pere Marquette, of which his father was general manager, but he did not remain long at office work. He wanted to go through the whole thing

MR. WILLIAM F. POTTER.

and left the comfortable office for the freight train service, where he went through the ordeal so searching to manhood. Freight train conductor, passenger train conductor, station master, assistant superintendent are some of the positions he filled, and always filled to the brim. There is nothing the matter with William F. Potter.

Mr. J. P. Young has been appointed general foreman of the car department of the Missouri Pacific at St. Louis, Mo., vice Mr. W. D. Lowry resigned.

Mr. R. A. Billingham, formerly general master mechanic of the Pittsburgh, Shawmut & Northern, has been made superintendent of motive power of the same road, with headquarters at St. Marys, Pa. The position of general master mechanic has been abolished.

Mr. H. H. Harvey has been appointed general car inspector on the Chicago, Burlington & Quincy at Chicago.

Mr. C. J. Nash, formerly mechanical engineer of the Pullman Company, has been appointed superintendent of the Standard Steel Car Company.

Mr. David Anderson, formerly division master mechanic of the Lake Erie & Western at Muncie, Ind., has been appointed superintendent of equipment of the Chicago, Indiana & Eastern, with headquarters at Muncie, Ind.

Mr. H. Muir, for the past fifteen years engineer on the Louisville Division of the Southern Railway, has been appointed road foreman of engines on the St. Louis-Louisville lines of the Southern Railway with jurisdiction from Lexington, Ky., to St. Louis, Mo., and over the Evansville and Jasper branches, with headquarters at Louisville, Ky. The territory thus covered is about 507 miles.

Mr. J. W. Marden has been appointed assistant master car builder of the Boston & Maine Railroad.

Mr. George W. Cooper has been appointed master mechanic of the Monterey Division of the Mexican Central Railway, with office at Monterey, Mex., vice Mr. T. H. Ogden transferred.

Mr. John W. Holmes, formerly chief clerk of the Brooks works of the American Locomotive Company at Dunkirk, N. Y., has been appointed assistant to the general purchasing agent of the company, with office in New York.

Mr. F. C. Eggebrecht, shop accountant of the Brooks works of the American Locomotive Company, has had the duties of chief clerk added to his other work, vice Mr. J. W. Holmes promoted.

Mr. E. T. McLaughlin has been appointed road foreman of engines on the eastern division of the Rome, Watertown & Ogdensburg Railroad with headquarters at Watertown, N. Y., vice Mr. C. W. Shaft transferred.

Mr. C. W. Shaft, formerly road foreman of engines on the eastern division of the Rome, Watertown & Ogdensburg, has been transferred to the western division of the same road in the same capacity, with headquarters at Oswego, N. Y.

Mr. S. M. Owen has been appointed general night foreman of the Terminal Railroad Association of St. Louis. His office is at the Fourteenth street shops of the company in that city.

Mr. William Miller, formerly master mechanic of the Terminal Railroad Association of St. Louis, has been appointed assistant superintendent of motive power of the Denver & Rio Grande Railroad. Mr Miller's headquarters will be at Denver, Col.

Mr. L. N. Rice has been appointed traveling engineer of the several divisions of the Chicago, Milwaukee & St. Paul Railway system with headquarters at Savanna, Ill.

Mr. J. W. Thompson has been appointed general manager of the Southern Indiana Railway, with office at Terre Haute, Indiana. The position of general superintendent, heretofore held by Mr. Thompson, has been abolished.

Mr. G. H. Folger has been appointed superintendent of the terminal division of the Boston & Maine Railroad, with office in the Union Station, Boston. The Union Station and Boston Passenger and Freight Terminals, including that portion of the Western Division west of the new Metropolitan Park Bridge, Medford; the Eastern Division west of and including Mystic River Bridge and west of Curtis Street, East Boston; the Southern Division south of Gilman's Bridge and the Fitchburg Division east of Prospect Street Bridge are now known as the Terminal Division.

Mr. H. E. Wills is a member of Division 125, Clinton, Ia. He was in the service of the C. & N. W. for a long term of years, being promoted to the position of engineer in 1868. He was for many years chairman of the G. C. of A. for that system, and chairman of the Legislative Board of Iowa. He was elected assistant grand chief engineer at the Los Angeles convention on June 3, 1904.

MR. H. E. WILLS.

Mr. M. W. Cadle is a member of Division 179, Sedalia, Mo. He worked his way up from engine wiper, and was promoted to engineer in 1879 on what was then the Illinois Midland, now Terre Haute & Indianapolis, when he joined Division 155. He went to the Missouri Pacific in 1884 and transferred his membership to Division 178. He was a part of the G. C. of A. on that road from 1887 to 1892, when he was elected chairman, holding the position until his election of assistant grand chief engineer at the Los Angeles convention, May 31, 1904.

MR. M. W. CADLE.

Mr. H. Rohwer has been appointed consulting engineer of the Missouri Pacific Railway; the St. Louis, Iron Mountain & Southern Railway and leased, operated and independent lines, with headquarters at St. Louis.

Mr. M. L. Byers has been appointed engineer maintenance of way of the Missouri Pacific Railway, the St. Louis, Iron Mountain & Southern Railway and leased, operated and independent lines, with headquarters at St. Louis.

Mr. E. F. Mitchell has been appointed engineer of construction of the Missouri Pacific, the St. Louis Iron Mountain & Southern Railway and all leased, operated and independent lines, with headquarters at St. Louis.

Mr. J. D. Tyter and Mr. C. L. Gilpatrick have been appointed assistant superintendents of the Terminal Division of the Boston & Maine Railroad, with offices in Boston, Mass.

Mr. Hayter Reed has been appointed manager in chief of the Canadian Pacific Railway Company's hotel department, with office at Montreal.

Mr. William Bowden, formerly general foreman of the Chicago, Burlington & Quincy Railway, has been appointed master mechanic of the Terminal Railroad Association of St. Louis, with headquarters at St. Louis, Mo.

Every railway man in the world, worthy of the name, has heard of the Westinghouse air brake. Comparatively few have seen its great inventor. Here is a wonderfully fine pen picture of the man taken from *The World's Work:*

"Mr. Westinghouse is more than six feet tall and well proportioned, erect as an oak, with large hands and feet, with broad, square shoulders, a full chest, a short bull neck, a massive head covered thickly with almost white, well-trimmed hair, a pleasant, open countenance with bright, brown eyes full of life and vivacity, a ruddy complexion, and the face distinguished by a heavy white mustache and not too deeply clipped side-whiskers; a being of permanent mobility. While walking, his step is quick, long, elastic, and when sitting, either his feet are moving or his hands are toying with whatever object is nearest—a pen, a pencil, a sheet of paper, or perhaps eyeglasses, which are used only when he reads. Add to this that the man before you is dressed in a single-breasted coat, of quiet, somber pattern, cut in the simplest fashion, and you have a picture of him."

Mr. E. W. Hurley is a member of Division 439, Boston, Mass. He was in the service of the N. Y., N. H. & H. system for some twenty-five years, and did committee work most of that time. He was for many years chairman of the G. C. of A. on that system, and held that position when elected assistant grand chief engineer at the Los Angeles convention, on May 31, 1904.

MR. E. W. HURLEY.

Work of an Honorable Fireman.

From a locomotive fireman's work of keeping her hot to the position of Commissioner General of Immigration is the ladder climbed by the Hon. Frank P. Sargent, who is said to be as popular among the statesmen of high degree in Washington as he was among those who repeatedly elected him Grand Master of the Brotherhood of Locomotive Firemen. Mr. Sargent has lately excited much talk and discussion by the plans he is pushing for placing immigrants in the localities where their willing hands are wanted for suitable labor. It has been the practice to permit immigrants to be dumped in large cities, where the labor market is habitually congested and depends upon thousands of poor creatures struggling for the means of existence.

Certain sections of this great country are always short handed, while other parts have more than they can use. If Mr. Sargent succeeds in making an even distribution he will be a concrete representative of perfect government, which rules that the greatest possible good may be given the greatest number.

Obituary.

Edward Hemphill Mullin, one of the best known of the old-time newspaper men, died suddenly from an attack of heart disease at his home in Milburn, N. J. Mr. Mullin was born in Castlederg, County Tyrone, Ireland, on October 22, 1859. He was educated at the Methodist College Public School of Belfast and the Queen's College, Belfast, where he took his Bachelor's degree with honors in Physics and Chemistry in 1881. Shortly afterwards he came to New York and engaged in newspaper work. From 1887 to 1895 he was an editorial writer on the staff of the New York *Evening Sun*. The two following years he spent on the staff of the *New York Times* in charge of the technical reporting for that paper. Subsequently he became editor of the *Bookbuyer*. He was a constant contributor to the magazine and technical press. On February 1, 1898, he entered the service of the General Electric Company, first as manager of its Advertising Department and latterly as a confidential representative of the company in many matters. He was the authorized representative of the company in all their relations with the press, and he was the official host of the company whenever foreign engineers or capitalists desired to visit the works or study their methods.

He was a thirty-second degree Free Mason and a member of the Engineers, Press, Lotus and Transportation Clubs. He was vice-president of the New York Electrical Society and a director of the American Institute of Electrical Engineers, also vice-president of the Association of American Advertisers.

One of the most popular railroad supply men in the country passed away when James S. Toppan died in Chicago on January 8. A strong feature about Mr. Toppan was his congenial unobtrusiveness. He was highly successful in his business, but his manner impressed his customers that they were receiving a friend rather than the agent of the Galena-Signal Oil Company, of which he was western manager for many years.

Before entering the railway supply business Mr. Toppan was engaged in mercantile affairs, mostly as an exporter of ice to oriental countries. While engaged in this trade he resided in Calcutta for a number of years and had traveled extensively. He was a keen observer of men, manners and methods, which made him a very interesting companion. He was one of our reliable sources of inside information, and we will sadly miss pleasant visits with our old friend.

JAMES S. TOPPAN.

Railway men and others who enjoyed the privilege of intercourse with William H. Baldwin feel a personal loss in his untimely death, which happened on January 3. William H. Baldwin was one of a number of college graduates who were induced by Charles Francis Adams to enter railway service at the bottom and work their way upwards. He entered the freight service of the Union Pacific in 1887, and rose steadily to the position of vice-president. He filled several high railway positions before 1876, when he was elected president of the Long Island Railroad, where he finished his work that always was of the highest kind. Besides being an exemplary railway president, Mr. Baldwin was a public spirited citizen, always standing on the side of human progress, of enlightened government, of honest politics and of every cause that sought to make the world better and the people who live in it happier.

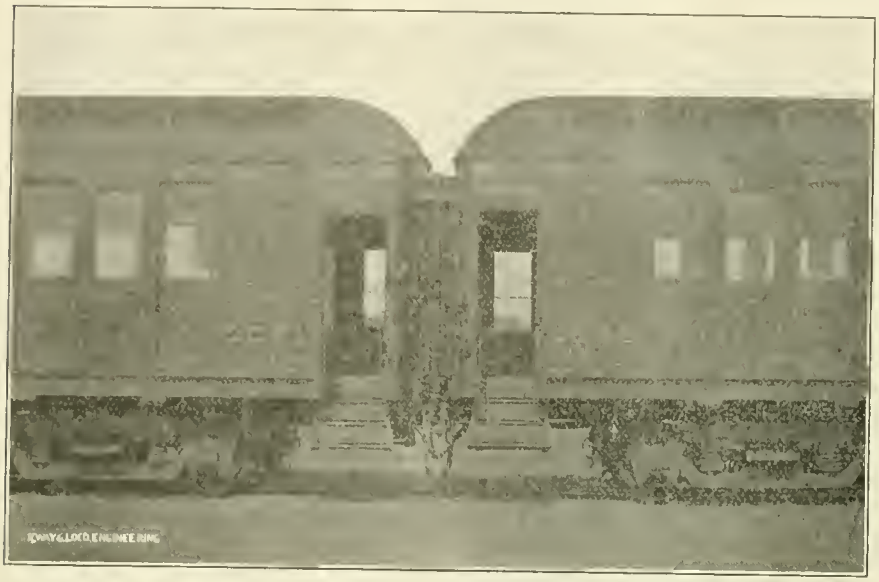
The death of Mr. William Sellers has removed a pioneer worker for the advancement of science and the upbuilding of the American steel and tool makers' arts. He was born on September 19, 1824, in Upper Derby County, Delaware, and his early education was gained in a private school built and conducted by relatives. He soon developed a fondness for mechanics, and when 14 years old became an apprentice in the machine shop of his uncle, Mr. J. M. Pool. Here he worked until he was of age, when he went to Providence, R. I., to take charge of the shops of Bancroft, Nightingale & Co., manufacturers of steam engines and mill gearing. Two years later he went to West Philadelphia and engaged in the same kind of business for himself. In less than a year his former employer, Mr. Bancroft, entered into partnership with him under the name of Bancroft & Sellers. During the time this firm was in existence, Mr. John Sellers, Jr., had been admitted, and when in 1855 Mr. Bancroft died, the firm name became the now universally known one of William Sellers & Co.

In 1873 Mr. Sellers became president of the Midvale Steel Co. About five years before he had established the Edgemore Iron Co. for the manufacture of structural steel. This firm made all the iron used in the famous Centennial Exposition of 1876, and all that was used in the Brooklyn Bridge over the East river at New York.

In 1864 he took the presidency of the Franklin Institute and devoted himself to the task of formulating the system of screw cutting now used all over this country, and which is variously called by his name, by that of the Franklin Institute and also the U. S. Government standard screw thread. It is this most important act in his long and useful life which perhaps more than any other will cause his name to be remembered wherever bolts and nuts are used.

Mr. Sellers not only contributed to the success of the Centennial Exposition in his own land, where his firm had extensive exhibits, but he won distinction abroad. At the Vienna World's Fair of 1873 his firm received the highest distinction and were the recipients of a diploma of honor. In 1889 his firm received the Grand Prix and medals for their exhibit of excellent machine tools, and Mr. Sellers was made a Chevalier of the Legion of Honor. He was for many years a director of the Philadelphia & Reading and of the Philadelphia, Wilmington & Baltimore

Railroad. In 1868 he was made a trustee of the University of Pennsylvania, he was also elected a member of the National Academy of Sciences, and next year he became a corresponding member of the Paris Société d'encouragement pour l'Industrie National. He died at the advanced age of 81, honored and revered alike at home and abroad.



VESTIBULE OF STEEL SIDE DOOR PASSENGER CARS.

Had No Use for Orange Color.

"Did you hear how Murphy spoiled his chance of getting an engine?" inquired one railroad man of another.

"No. How did it happen?"

"Why, they were testing Murphy's eyes to see if he would be all right on colors. Everything went along smoothly until they put out an orange colored card. When the smoke cleared away, instead of having an engine Murphy was in jail on seven different charges, ranging from assault with intent to kill, to wilful destruction of property."

Steel Side Door Passenger Car.

The steel-frame side door car here illustrated is used on the Illinois Central Railroad, and is adaptable for suburban, interurban, elevated or subway service, and its advantages are the same whether the motive power be steam or electricity. Its interior is arranged with a row of bench-form seats, so placed in sections across the width of the car as to leave side and end aisles following the walls around the entire interior, and section aisles between each group of seats; thus providing for an expeditious movement to any part of the car when necessary, or from one car to another, there being ordinary swinging doors at each end for the latter purpose. Ingress and egress to the car is by side doors, of which it has twelve on each side, or a total of twenty-four side doors to the car, which doors open opposite and directly in line with a section aisle. It will hence be seen that, the car being entered by these side doors from an elevated platform the height of the car floor, the passenger has at the least to take but a few steps from the platform to any of the eight seats directly in front of him that may be vacant, or at the most, in case the opposite seats are full, has the means of readily getting to the nearest vacant seat.

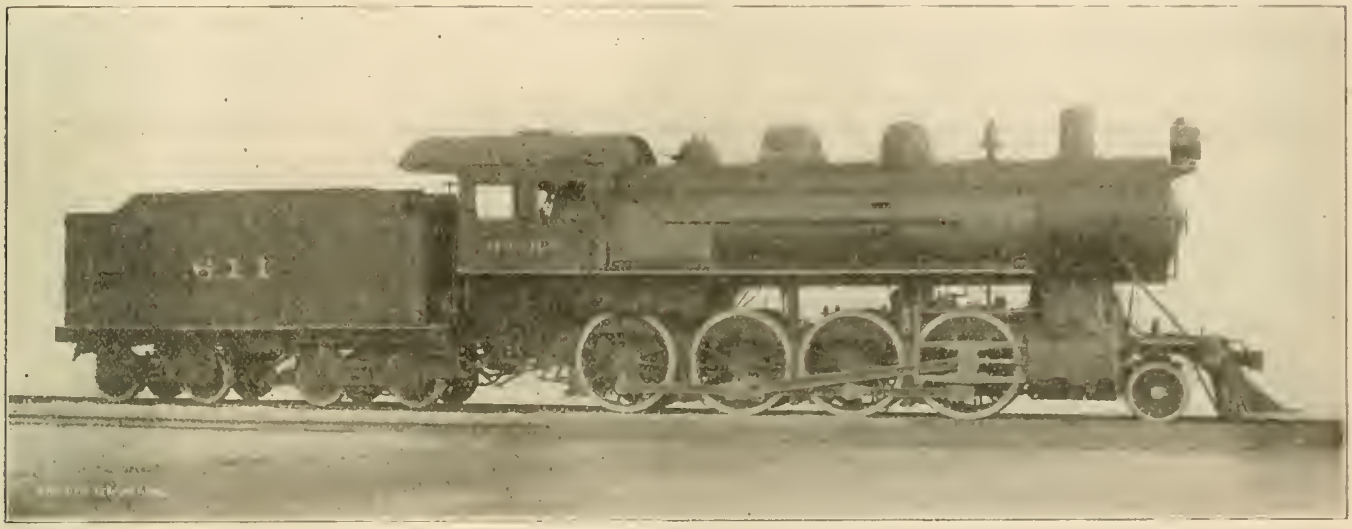
The side doors are mounted at the top on ball-bearing rollers and slide in and out of the spaces in the walls of the car. The thresholds are flush with the floor. The controlling mechanism is located at the ends of the car and is operated by the trainman.

The bench-form seats are of an entirely new design, each section seating eight passengers. They are constructed throughout of mahogany, with straight backs 42 ins. high. No upholstering is used. The seat bottoms of solid mahogany are of modeled form. There are a total of 100 seats in each car.

The side door car of the Illinois Central is quite unlike that used on English railroads, not alone in the details but in the principles of its design. In the first place the swinging door is discarded, and the danger to which passengers on the station platforms and in the car are exposed by doors opening unexpectedly when trains are in motion, is eliminated. Instead of the swinging compartment doors, each one of which has to be opened and closed separately, sliding side doors are used which are operated and controlled by ingenious mechanism within the walls of the car, so that all the doors may be opened and closed together or separately, as occasion may require, by the trainman in charge of the car. This arrangement admits of the instant and perfect control of all the doors from either end and both sides of the car, effecting great saving in time over the swinging-door method.

TRAIN OF STEEL SIDE DOOR PASSENGER CARS ON THE I. C. R. R.

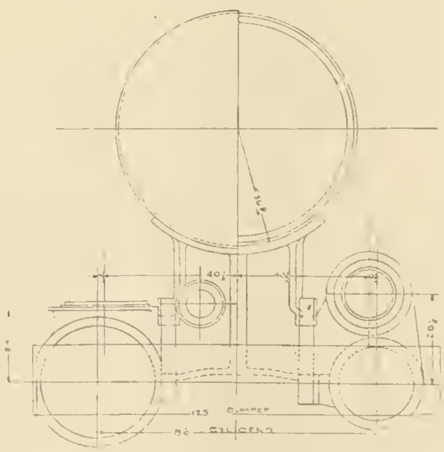
Next to the sliding door, the abolition of the interior compartments and the opening of side aisles are the most noticeable differences, affecting not only the appearance but the use of the car. By the use of aisles extending the entire length on both sides of the car, as in the new cars, passengers may enter



CROSS COMPOUND CONSOLIDATION FOR THE M. C. R. R.
E. D. Bronner, Supt. of M. P. and Equipt. American Locomo'ive Company, Builders

at once any of the side doors, and if vacant seats are not found immediately at the entrance, they can pass along the aisles to other parts of the car, or, if necessary, through the communicating end doors of the vestibules to other cars where seats may be found; hence, the train meanwhile having resumed motion, no time is lost waiting for passengers to find seats.

In this country, with the steadily increasing density of passenger traffic upon railroads having a suburban business, and particularly upon the elevated and subway lines handling a heavy metropolitan traffic, the limitations of the end-door cars have become apparent. The remedy usually applied of increasing the number of trains does not afford the desired relief, for the reason that no improvement can be effected in the crowding of passengers at the ends of the cars, with the incidental surging, struggling efforts of many persons to gain immediate entrance through the end doors. The remedy lies in preventing the formation of the crowded groups at the ends of cars, and of distributing the passengers evenly over the entire length of the station platform, so that when trains arrive people may step directly and conveniently from the platform to the side doors of the cars and avoid the uneasy movement up and down the platform to get opposite the end entrances at their more or less uncertain points of stoppage. This result is obtained in the new cars, with their twelve sliding side doors on each side spaced five feet from center to center throughout the length of the car. This steel-frame side door passenger car was exhibited at the Louisiana Purchase Exposition. It attracted considerable attention owing to the many new and novel features that enter into its design and construction. These features were originated by Messrs. A. W. Sullivan, general manager of the Missouri Pacific system, and William Renshaw, superintendent of machinery of the Illinois Central. This steel-frame side-door car is one specially adapted for protection against fire and telescoping, owing to the exclusive use of steel in the underframe. These cars were built by the St. Louis Car Company, of St. Louis, Mo.



SECTION OF M. C. R. R. CROSS COMPOUND.

A Michigan Central 2-8-0 Freighter.

A good example of a heavy consolidation freight engine is here illustrated. It belongs to the Michigan Central Railroad and was built by the American Locomotive Company, at their Schenectady shops. The engine is a "cross" or two-cylinder compound and has a piston valve on the high pressure side and an ordinary balanced Allan-Richardson valve on the low pressure cylinder.

The cylinders are 23 and 35 ins. in diameter, with 32 ins. stroke, and the driving wheels are 63 ins. in diameter. With 210 lbs. boiler pressure the calculated tractive effort is about 37,600 pounds. The weight on the drivers is about 174,000 pounds, and the ratio of tractive effort to adhesive weight is as 1 is to 4.6. All the wheels are flanged, and the pony and the two pair of leading drivers are equalized together, and the main and rear drivers are equalized together. The pistons on both sides drive on the third pair of 63-in. wheels, and this axle carries the eccentrics which operate a link of 50½ ins. radius, a transmission bar passing over second driving axle, with indirect valve motion.

The frame is very securely cross braced in front and in rear of the main driving axle by strong steel castings lipped down over the upper frame bar and securely bolted to the same. The leading and second drivers have overhung springs standing on high driving saddles and the main and rear drivers have driving box equalizers, a semi-elliptic spring between frame bars and between wheels and nests of coil spring in front of and behind the main and the rear drivers. The crosshead is of the alligator type and the under edges of the top guide are notched out so that sides of guides and sides of crosshead run flush with each other, which is a design intended to prevent dirt and grit working in, while it gives the same total width of bar for resisting the upthrust of the crosshead as the engine is running forward.

The boiler is of the straight top type and measures 70⅛ ins. diameter at the smoke box end. There are 359 tubes, 2 ins. diameter and 15 ft. 7 ins. long. These tubes give a heating surface of 2,911.6 sq. ft., and those supporting the brick arch, 23.4 sq. ft. When added to the heating surface of the firebox, which is 156.3 sq. ft., there is found to be a total of 3,091.3 sq. ft. exposed to the flame and heated gases from the firebox. The grate area amounts to 50.15 sq. ft. The boiler is supplied by two Hancock Inspirators. The firebox is one of the wide type being 75⅛ ins. wide by 96 ins. long, with a depth, front of 70¾ ins., and back 60¾ ins.

The tender is carried on a steel channel under frame and the tank with its water bottom has a capacity of 6,000 U. S. gallons, and will carry 14 tons of coal. Two Fox pressed steel trucks and bolsters are used. The tender weighs empty 50,000 pounds. A few of the leading dimensions are appended for reference:

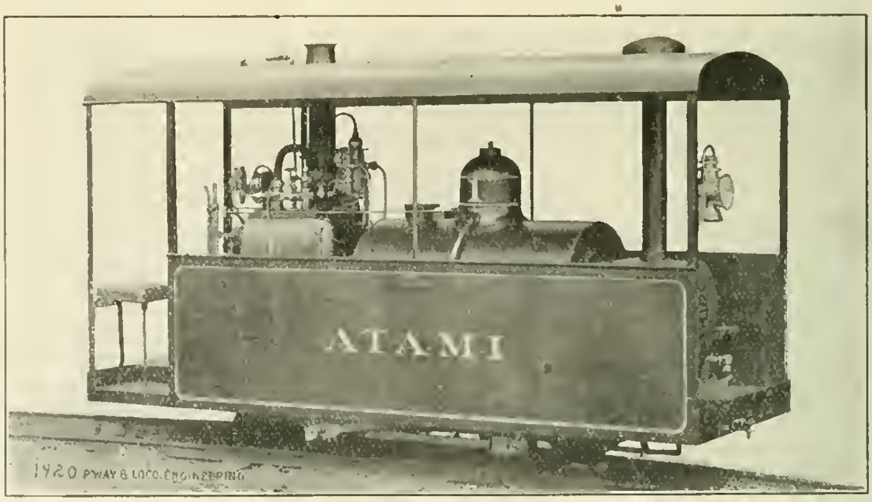
General Dimensions—Weight in working order, 198,500 lbs.; weight engine and tender in working order, 326,500 lbs.; wheel base, driving, 17 ft.; wheel base, total, 25 ft. 9 ins.; wheel base total, engine and tender, 55 ft. 1 in.

Cylinders—Size of steam ports, L. P., 23x2⅜ ins.; size of exhaust ports, L. P., 23x3 ins.; size of bridges, L. P., 1⅜ ins.

Valves—Greatest travel of slide valves, 6 ins.; outside lap of valves, H. P., 1¼ ins.; L. P., 1 in.; inside clearance of valves, H. P., ⅛ in., L. P., ¼ in.; lead of valves in full gear, H. P. line and line in full gear, F. and B., L. P., 1/32 in.; lead in full gear, F. and B.

Boiler—Thickness of plates in barrel and outside of fire box, ¾, 13/16, ½ and ⅝ in.; fire box plates, thickness, sides, 7/16 in.; back, ⅜ in.; crown, 7/16 in.; tube sheet, ½ in.; fire box, water space, 4 ins. front; 4 ins. and 5½ ins. sides; 3½ ins. and 4½ ins. back; fire box, crown staying, radial; tubes, No. 11 B. W. G.

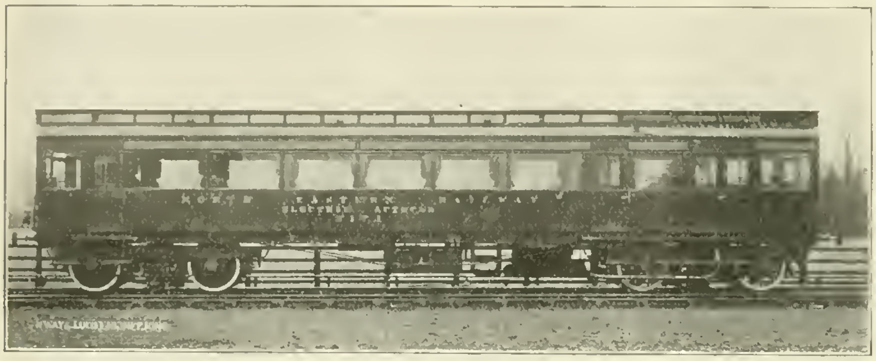
Tender—Journals, diam. and length, 5 ins. diam by 9 ins.; wheel base, 18 ft.; tender frame, 10 in.; channels, 11/16 web.



NARROW GAUGE, ONE MAN ENGINE FOR JAPAN.

The Heaviest Gasoline Propelled Vehicle in the World.

BY ÉMILE GUARINI.



GASOLINE MOTOR CAR ON THE NORTH EASTERN OF ENGLAND.

The North-Eastern Railway Company, of England, have lately introduced a service of gasoline electric motor coaches between Hartlepool and West Hartlepool. Each of these coaches seats 52 passengers, is 52 ft. long, and weighs 37 tons. On the official test, speeds of over 40 miles per hour were easily attained. Each coach is divided into three compartments, the center one being the passenger compartment, the forward one containing the gasoline electric generator, switch-gear, controlling and braking mechanism for operating the coach from that end. The rear compartment contains simply the controlling and braking mechanism for operating from that end. The coach is lighted by twenty-four 16 C.P. incandescent lamps, worked from accumulators carried under the floor.

The prime motor is a Wolseley 80 h.p. 4 cylinder gasoline engine. The 4 cylinders are each 8½ in. bore by 10 in. stroke, giving 81 B.H.P. at 420 revolutions, and with an acceleration, up to 480 revolutions, the engine gives 93 h.p. The cylinders work in pairs on 2 crank pins at 180° from each other, thus obtaining 2 impulses every revolution.

The generator, which is direct coupled, is of the separately excited and compound wound direct current type, specially designed for operating over a range of voltage from 300 to 550 with a normal speed of 420 revolutions per minute. The field of the generator is split horizontally so that the upper half may be removed for access to the armature or field coils through an opening in the roof of the car which is fitted with a removable cover.

Two Westinghouse standard railway motors with single reduction gears, ratio 18 to 61, are mounted on the front bogie by means of a nose suspension bar with spring attached to the bogie frame. These motors are series wound and are of he type usually employed for operating heavy high speed tram cars.

The controllers are the standard series parallel tramway type arranged for electric braking. Resistances are provided in connection with the controllers for gradually increasing the voltage of motors in starting the trains, and for graduating the electric brake in stopping. These resistances are mounted beneath the car.

The storage battery consists of 38 cells in ebonite jars, assembled in a wooden box suspended beneath the car. Each battery has a capacity of 120 ampere hours. The choking and accelerating levers, and all controlling apparatus, are conveniently situated in the engine room. The necessary gear, such as brakes, controllers, etc., for driving the coach, is installed in duplicate, one set at each end of the car, to enable the driver to occupy the front of the car going either way.

The Westinghouse automatic air brake is provided, acting on all wheels, and the air compressor being operated by a small electric motor. Powerful screw-on compensated hand brakes are also provided, a brake wheel being fixed at each end of the coach.

A siren is fitted to each coach, and is operated by compressed air from the brake reservoir. Gasoline and water tanks are provided of sufficient capacity to enable the car to run continuously for 9 hours at speeds up to 30 miles per hour.

These self-propelled railway cars are designed to meet the need for an auxiliary railway service, to act as a feeder to main lines and to enable a self contained car to carry passengers, baggage and mail in whatever proportion desired over routes in outlying and thinly populated districts where a regular service is a necessity. During sudden temporary increases in the traffic, cars of this type could be sandwiched between the regular trains, and it would in all probability prove satisfactory to keep two or three of these self-contained coaches at important centers, to be used instead of "specials." All this can be accomplished without any alteration to existing permanent way.

Liliputian Engine for Japan.

The Baldwin Locomotive Works of Philadelphia have recently built some two-foot gauge engines for the Atami Light Railway of Japan. This road is 16 miles in length and runs from Yokohama to a pleasure resort in the mountains. The rails on this road weigh from 8 to 10 lbs. per yard.

The engine weighs in all 5,550 lbs., and of course all this is on the driving wheels which are four in number. The cylinders are 4½x10 ins. and the driving wheels are 20 ins. in diameter, and the calculated tractive effort of this liliputian locomotive is about 1,030 lbs. The main valves are ordinary D-slides.

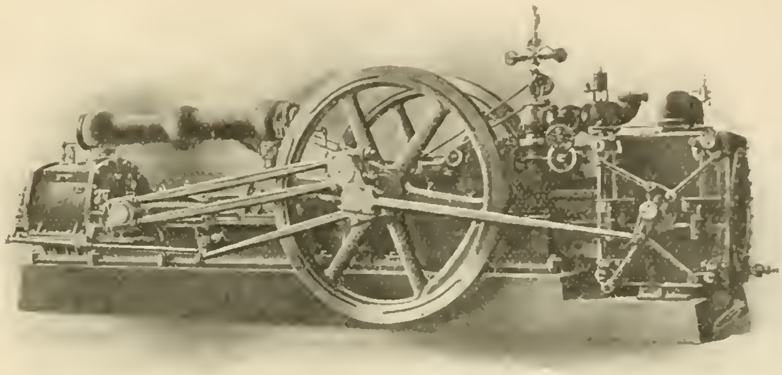
The boiler has a Belpaire firebox and a saddle tank, containing 50 gallons of water, is carried on the barrel. The diameter of the boiler is 16 ins. The heating surface is 52.4 sq. ft. in all, made up of 11.8 in the firebox, 40.6 in the tubes. The grate has an area of 1.91 sq. ft. The tubes are 1½ ins. in diameter; there are 23 of them and they are 4 ft. 7 ins. long. The wheel base of the engine is 3 ft. 6 ins.

The fuel is soft coal, and the firing and running are done by one man, and all levers, valve handles, etc., can be reached by him without leaving his seat. The little engine is intended to supersede coolie labor on these narrow gauge roads in Japan. The government ordered the railways to substitute more modern power, as many of the coolies engaged in pushing the cars on these small roads died of tuberculosis brought on by excessive physical exertion. If these engines prove to be a success other orders will follow.

The Function of Skip Valves.

Skip valves is the name applied to a new and ingenious feature of the air compressors being made by the Norwalk Iron Works Company, of South Norwalk, Conn., and by means of this arrangement two pressures can be had from one air compressor.

There are in most shops a demand for air at from 20 to 25 lbs. used for paint spraying, sand blast work, etc., and also a demand for air at a pressure of from 80 to 100 lbs., for pneumatic tools, hoists, etc. A plan frequently employed is to compress the air up to the higher pressure and use it for the low pressure services by passing it through a reducing valve. This is not an economical method, and to avoid employing it some shops use two compressors, one supplying high pressure and the other low pressure.



NORWALK AIR COMPRESSOR.

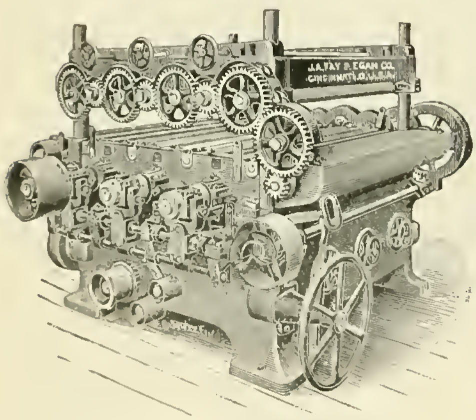
Where one compound compressor is used, air at low pressure is delivered to the inter-coolor by the action of the piston of first cylinder, and is constantly being drawn out by the piston movement in the second cylinder, and when air at low pressure is drawn off for shop use, and the second cylinder is taking it also, the pressure in the inter-cooler cannot be kept up unless the second cylinder be shut off from time to time, as occasion demands.

The Skip Valves obviate the necessity for shutting off the second cylinder, and yet are responsible for the proper maintenance of the pressure. These Skip Valves are the inlet valves of the second cylinder, and when the pressure in the inter-cooler falls below a certain predetermined amount, the Skip Valve remains open, so that the second cylinder simply draws in air and discharges it back again into the inter-cooler. By this method the machine keeps constantly in operation, and yet when occasion demands, it ceases the work of higher compression, and the air can be maintained and used at the lower pressure.

The Skip Valves automatically adjusts the amount, remaining open one, two or more revolutions, or even the fraction of one revolution, as required. The speed and pressure governors make the machine run so as to suit the demands of the low and of the high pressure systems. The Skip Valve is an ingenious appliance, and the Norwalk Company will be happy to send a copy of their folder to anyone who applies to them for a copy.

Patent Sanding Machine.

Our illustration is of a sanding machine especially designed for car shops. It was patented March 20, 1900, and has embodied in its make up many new points which insure its doing good work. The machine is invaluable where a perfectly smooth surface is desired either for varnishing or painting. It is massive



No. 4 TRIPLE DRUM SANDER.

and substantial, and saves the work of several machines for doing this character of work. The three steel polishing cylinders upon which the paper is placed have a vibratory motion to prevent the formation of lines, and are equipped with a device for quickly applying the sandpaper, and giving it the proper tension. Each cylinder carries a different grade of paper, the third cylinder giving the final and smoother finish.

The feed is very powerful and consists of eight feed rolls, four above and four below, driven by a train of heavy expansion gearing, and will open to receive material 8 ins. thick. The machine is made to work material from 30 to 80 ins. wide, and has a brush attachment which cleans the stock after it has passed through the machine. The pressure rolls are so arranged that the adjustments can be made easily, quickly and accurately, and the feed started and stopped instantly.

The makers of this improved sander, J. A. Fay & Egan Co., No. 445 W. Front street, Cincinnati, O., will be glad to hear from those interested, to whom they will submit prices, information and cuts showing the machine in detail.

Manning, Maxwell & Moore.

The whole of the railway world is familiar with the name Manning, Maxwell & Moore. So far as the railway connections with this firm goes, the personality is Charles A Moore, the great, big man, mentally and physically, who carries an air of confidence along with him and makes every customer feel he is dealing with a man in whom he can place infinite trust. Mr. Henry S. Manning, the other partner, is more retiring and is comparative little known among railway men, which is their loss.

The announcement is now made that Henry S. Manning had sold to his partner, Charles A. Moore, his entire interest in the firm of Manning, Maxwell & Moore, and in the various manufacturing concerns owned and controlled by the firm, viz., the Ashcroft Manufacturing Company, Bridgeport, Conn.; the Consolidated Safety Valve Company, Bridgeport, Conn.; the Hancock Inspirator Company, Boston, Mass.; the Hayden & Derby Manufacturing Company, Boston, Mass., and the United Injector Company, Boston, Mass.

Mr. Moore has also bought Mr. Manning's interest in the Shaw Electric Crane Company, of Muskegon, Mich., which he now owns and controls, and is president of the above companies.

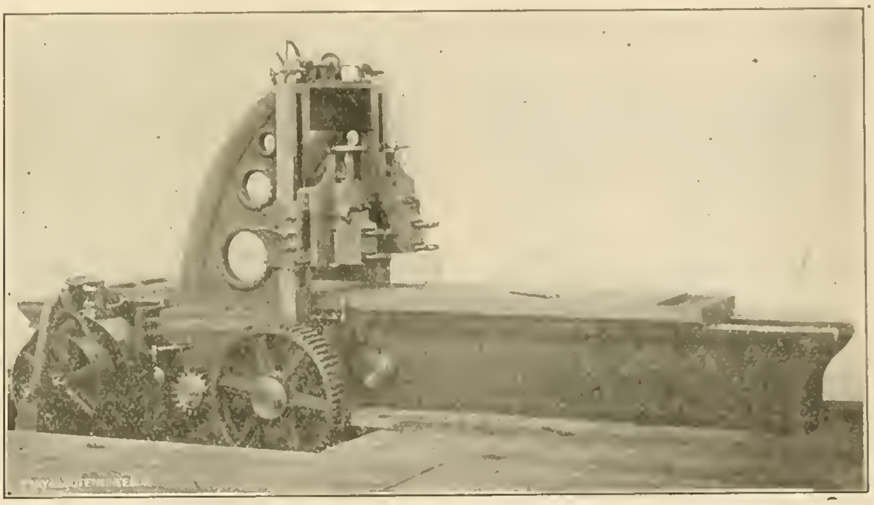
Graphite for January, that is the house organ of the Joseph Dixon Crucible Company, of Jersey City, has come to hand with other good things of the new year. It is not out of place to say that *Graphite* has made its mark, and this number being devoted to the matter of lubrication is no exception to the rule. There is a good article on the causes of friction and the theory of graphite lubrication. The account of the launching of *U. S. S. Connecticut*, with an A1 picture of the same, is most interesting. The "ways" on which she slid were two great rails built of 12x12 in. yellow pine. The lubricants used were, first a coat of candle grease, which became very hard on cooling. Next came a substantial layer of tallow and over this, common yellow grease was thickly spread. On top of all was Dixon's No. 1 Ticonderoga Flake Graphite, and when the champagne bottle crashed on the bow, the great battleship simply slipped into the water and floated off, a thing of beauty and a joy forever. There is a lot of interesting and instructive matter in this issue and the Dixon people will be happy to send it to those who apply to them for it.

Frog and Switch Planer.

The planer here illustrated is a frog and switch planer and has been built in a very substantial manner, so as to be able to stand up to the heavy and constant work which it is expected to do. It is capable of planing 36 ins. high and 36 ins. wide, or over a space 914 millimeters square, according to metric measurement.

The movement of the table is at right angles to the line shaft, and the gear wheel and pinion are broad faced and are solidly mounted. The table is gibbed down to the bed, so that lifting or side movement is impossible, and this assures the accuracy of the machine. The heads are made right and left, and have power, cross and down feed, but do not have angular setting. The tool boxes swivel to give clearance to the tools.

The housings are backed with heavy webs which extend back a considerable distance along, and are firmly bolted to the planer bed; any length within the limits of the table movement can be planed. The dimensions of the countershaft pulleys are 20x5½ ins. and the number of revolutions at which the machine is run is 280 per minute. It is made by the Niles-Bement-Pond Company, of New York, who will, if asked, give further particulars concerning the planer.



FROG AND SWITCH RAIL PLANER.

A Lazy Tongs Made Active.

All kinds of mechanical movements and all kinds of combinations of iron, wood and steel have no terrors for the fertile inventor. One device, a description of which we recently noticed in the pages of the *Official Gazette* of the U. S. Patent Office, was the adaptation of the lazy-tongs principle to the prevention of collisions.

The idea was, briefly, to place a sort of collapsible lattice-work frame in front of a locomotive. This "structure" was intended to extend a considerable distance ahead of the train and to be supported here and there upon trucks; a buffer bar arranged in front of the forward truck, with springs, electric contact-points, etc., goes gayly along looking for trouble.

A lever in the cab extends or draws back all this flexible lazy-tongs apparatus, so that when it is all in, it folds up into pretty nearly the distance occupied by three trucks, but when it is out at full length you could not get near that smoke box with any number of long poles.

The beauty of this idea is that when two engineers forget all about their orders or run past stop signals set against them, they can extend the far-reaching lazy-tongs collision destroyer and go into one another like Knights tilting in the days of old.

When they meet, the buffer bars strike fire and the lattice-work framework of each engine quietly shuts up and both engines are brought slowly to rest at a minimum distance of about six truck lengths apart, which would be comfortable speaking distance for each crew to bad word the other. It is not very clear what part the electrical contact points play in the operation of collision destroyer, but perhaps if the lazy tongs felt like shutting up too abruptly, a powerful current might be turned on, which would weld all the wheels to the rails and so prevent the engines getting "together" any further.

The merit of the celebrated Moncrieff Scotch gauge glasses has been strikingly brought out in the fact that these glasses were the only ones awarded a gold medal at the recent St. Louis Exposition. They received the highest award. The H. A. Rogers Co., New York, sole agents in the United States, report a large and steadily increasing demand for these gauges.

Unconscientiousness.

A vaudeville artist in humorously describing a person in a faint said that he was in a state of "unconscientiousness." We rather suspect that the persons who, according to the St. Paul *Dispatch* and the Topeka *Capital*, recently sent in money to the Wisconsin Central and to the Kansas Southwestern railways, had awaked from their state of unconscientiousness to one of acute probity and honor.

The letter to the Wisconsin Central, addressed to Mr. J. C. Pond, contained 94 cents in stamps and read as follows:

"Dear Sir: Enclosed stamps to be added to the Wisconsin Central for riding on hand-cars and gravel trains, and so forth. Six cents more for riding on train when train was wrecked. Please add this to the Wisconsin Central Railroad Company. And please forgive me for my past deceiving life. I know something better now."

The letter to the Kansas Southwestern contained a post office order for 75 cents and the writer expressed his sorrow for past wickedness in these words:

"Dear Sir: When I was a small child I took some of the railroad's coal, which I wish to pay for, as I am now a child of God, and heaven and lost souls are my only desires."

The Monarch Railway Supply Company has been organized to handle railway specialties. In addition to several other manufacturers, they have made arrangements with the Pressed Steel Car Company for the sale of their trucks, bolsters, brake beams and steel car-lines. The temporary offices of the Monarch company are at 614-618 Majestic Building, Detroit, and permanent offices will be located in the Penobscot Building, Detroit, after May 1, 1905. Mr. H. W. Frost is president of this company.

Another "L" Puffer Heard From.

It seems that the Providence & Burrville Street Railway Company know a good thing when they see it, if a Woonsocket local paper is anything of an authority on the matter. This company not long ago bought one of the little Forney engines, which used to run on the Manhattan Elevated Railway in New York. This machine was recently overhauled in the Rhode Island shops of the American Locomotive Company, and was repainted and appropriately lettered before becoming an adjunct to a street car line.

We are told that it came from Providence coupled in a freight train, but we were pleased to learn that it was indignant enough to boil its own H_2O and was in steam when it arrived. A temporary track had been laid from the steam road to the street car line, and over this piece of track the little "L" puffer proceeded alone, with becoming dignity and circumspection. It went to the end of the new line under construction, which is another way of saying that it went fearlessly to "the front." It weighs in all about 27 tons, but you must remember that these New York elevated engines long ago acquired the habit of "looking down" on street cars and probably regard a third rail for a railway, much as we would a "fifth wheel to a coach." The 0-4-4 engine from New York has taken charge of the construction of the street car line.

Cleveland Twist Drill Facts.

In the year 1874, Mr. J. D. Cox, in a very modest way, established himself in Cleveland for the manufacturing of tools. Five years later, Mr. F. F. Prentiss joined him as partner. For 25 years this partnership went on uninterruptedly, and was known to the business world as "Cleveland Twist Drill Co." During this period, by careful management and with constant efforts toward producing tools of the highest quality, the factory was built up as increased business demanded, and was equipped with special tools and modern machinery and appliances.

After thirty years of constant activity Mr. Cox decided that he had earned rest and relief from responsibility; with this in view, the partnership was merged into a stock company, December 31, 1904, and is now known as "The Cleveland Twist Drill Company." Before transferring the partnership affairs to the stock company, several of the old employees were invited to take stock. This opportunity was readily accepted by all to whom the privilege was accorded.

While Mr. Cox will be relieved of active duties, he will still retain his large holdings and also serve in the capacity of vice-president and director. The other officers of the company are: Mr. F. F. Prentiss, president and general manager; Mr. E. G. Buckwell, secretary; Mr. Geo. F. Kast, treasurer. Notwithstanding this change, the personnel of the company remains intact, and the moving spirit which shaped the policy of the concern in the past will animate it in the future.

Submarine Boat.

The opinion prevails that the submarine boat are an invention of recent origin; but that is a mistake. Some of the first experiments made by Robert Fulton were with submarine boats.

In 1801 Napoleon assigned a sum of money to Fulton to be devoted to experiments with steam boats. He had a small boat built which he called "Nautilus," with which he made many displays in the neighborhood of Brest, France. He immersed the boat a great many times, going down as deep as fifteen feet and returning to the surface by the motive power of the engines. At one time he had the boat under water for one hour and forty minutes. No new invention ever worked more successfully than Fulton's submarine experiments, and the only reason why nothing of importance came of the experiments was that Napoleon could not perceive how it could be turned to practical use.

The Falls Hollow Staybolt Company, of Cuyahoga Falls, Ohio, have recently received an order for several thousand feet of double refined charcoal iron hollow bars for use in a number of engines which the Baldwin Locomotive Works people are building for an important road in Brazil. The Falls Hollow Staybolt Company have made a number of improvements in their plant during 1904. They built a large addition, installed new water wheels and other equipment, erected new furnaces and in all doubled the capacity of their plant. The company report a considerable advance in business and say they are receiving orders from all parts of the world and that the trade with the railroads at home and in Canada and Mexico was in 1904 just double that of the year before.

Pangborn's Railway Antiquities.

The city authorities of Philadelphia have offered one of the buildings of the National Exposition for the accommodation of the railway antiquities that have been collected by Major Pangborn, under direction of the Baltimore & Ohio Railroad management, and recently exhibited at St. Louis. This is already the finest collection of railroad antiquities in the world, as many other appliances could easily be added to it, if the necessary funds were available. Meantime the collection will be sent back to the Field Museum at Chicago, but it will not be kept there permanently, as the managers of the museum say that they cannot spare the space required.

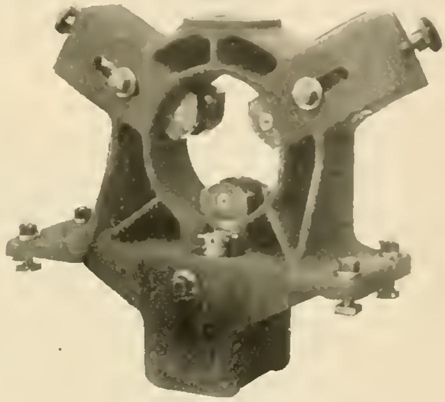
Meanwhile the people of Baltimore want this collection of railroad antiquities preserved in their city, and it would be a very proper and fitting thing to do, for most of the collection originally belonged to the Baltimore & Ohio Railroad, and that company has done more than any other to have interesting railroad relics preserved.

In our January issue we made reference to an illustrated catalogue of taps and dies and like tools, which had come to us from the J. M. Carpenter Tap and Die Company, of Pawtucket, R. I. Our printers managed to leave out the "pen" in the firm's name and made the word read Carter. For this slip of the "pen" we apologize and beg to say that the catalogue is worth looking over, and when you write the company for a copy be careful about the name and spell it correctly. The name is Carpenter.

Follower Rest for High Speed Steel.

Experience has shown that for taking a roughing cut on bars of 8 ins. diameter, a substantial support or follower rest is necessary if one is to obtain the best results from the use of high speed steel. In producing the kind of rest required the Lodge & Shipley Machine Tool Company, of Cincinnati, Ohio, made quite a number of experiments and used several different metals for the jaws of their follower rest. The follower rest here illustrated is the outcome of their labors.

The rollers in this rest are hardened tool steel and are mounted upon hard-



FOLLOWER REST FOR HIGH SPEED STEEL.

ened and ground steel shafts, upon which they are fixed by screws through the face of the rollers. The design includes liberal oiling facilities for the journals of the roller shafts. A sensitive adjustment for the jaws has been provided by the use of knurled knobs, so that they cannot be forced down too tightly. The company provides for special cases, so that if required the pad at the top of the rest can be planed and an angle bracket carried from this to attach to the wings of the carriage on the opposite side. This insures great stiffness and rigidity. So arranged, the output of a good high speed lathe is very materially increased.

The Burlington route has taken the farmers of the country under its sheltering wing and will hereafter specially instruct them in agricultural pursuits. The road this week started a special "seed train" from Lincoln, Neb., bearing a crowd of college professors, agriculturalists, seeds and demonstration charts and machines. This train will make stops at all important stations, while its occupants deliver lectures to the farmers. Not only Nebraska will be covered, but also Iowa and Illinois. Early in January the corn special will move through Illinois, into Iowa in February and Missouri in March.

As proof that manufacturers in England and on the Continent are awakening to the fact that pneumatic tools and appliances are a necessary adjunct to their business, we may mention that the Chicago Pneumatic Tool Company, of Chicago, have lately received a cablegram for 705 tools through their London branch. The Consolidated Pneumatic Tool Co. This company's business for the month of November, in the number of orders received, exceeded that of the corresponding month last year and also that of the previous month, viz., October, 1904. President Duntley, who was lately in England, says that the demonstrations of the electric drills corresponding in sizes to their "Little Giant," which were given over there, have proved to be a great success, and inasmuch as there is a market for drills of this kind, the company expects in time that the electric drill business will exceed that of pneumatic drills.

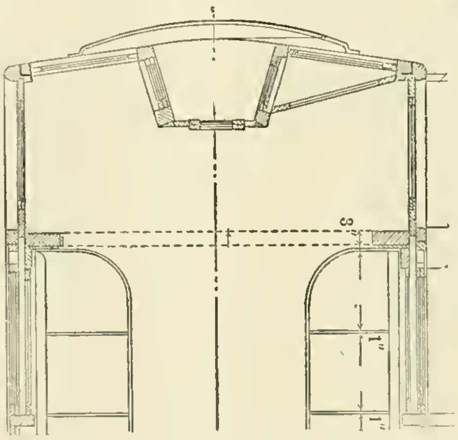
The proceedings of the Twelfth Annual Convention of the Traveling Engineers' Association is out and makes another valuable contribution to those interested in highly practical work done "to improve the locomotive engine service of American railroads." As usual, the report is well filled with excellent reports and papers that were discussed in the healthy spirit for which the Traveling Engineers' conventions are celebrated. Secretary Thompson deserves credit for the careful manner in which the report is gotten up and for the faithful reports of the numerous speeches. The Annual Report is for sale in this office; $1.00 for leather and 75 cents for paper cover.

All-Steel Car for the Metropolitan Elevated in Chicago.

The Metropolitan West Side Elevated Railway, of Chicago, has recently received some all-steel cars from the American Car & Foundry Company. These are not unlike those built for the Boston Elevated and for the New York Subway.

The side sill of the car is a 6 in. channel, to which is riveted a 1/4 in. steel plate which is also secured to an angle iron below the window sills, thus making a continuous plate girder along each side of the car. The cross sills of the car are made of 6 in. I-beams and the steel floor rests directly upon these beams. Above this sheet steel floor there is a 2 in. space filled with mineral wool and upon wooden cross strips, 2 ins. deep, an ordinary wooden floor with wearing strips in the aisle, is placed. The steel floor plates are 3/16 in. thick on the center of the car, but from the bolsters to the ends, 5/16 in. plates are used.

The car has no platforms in the ordinary sense of the word, but sliding doors are placed in the corners of the cars and they run back behind the side wall of the car, but do not in any way narrow the seating capacity of the cars on that account. A feature of this vestibule system is a niche in which the guard stands when opening the side doors. The niche is practically outside the car, though the hood of the roof covers it in the usual way. The niche is 21¼ ins. deep. The car aisle opens into the vestibule almost the full width of the car and the end seats have rounded corners to facilitate the movement of people in and out. A door which folds back from a corner



VESTIBULE WITH NICHE FOR GUARD—CHICAGO ELEVATED.

of the niche makes the motorman's box and at the same time gives maximum passageway for the public on the other side.

The only wood used in the construction of this car is the roof, the window sills, the floor, wood furring placed between the posts and some other small details. The seat frames are of pressed steel of the Hale & Kilburn pattern, like those used in the New York Subway. The car weighs about 48,000 lbs. without motors. It is very substantially built and is very strongly braced.

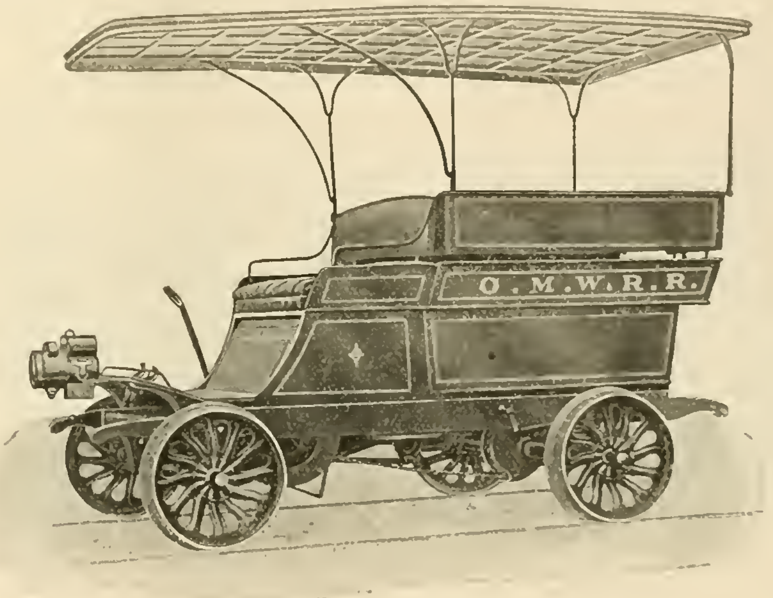
J. A. Fay & Egan Co., of Cincinnati, Ohio, manufacturers of wood working machinery, announce the opening of their new offices in Chicago, in the Railway Exchange Building, Suite No. 751. The offices will be in charge of Mr. Everett S. Kiger. They will do all business in this territory direct, discontinuing Messrs. Manning, Maxwell & Moore, of Chicago, as their agents. Persons who contemplate visiting Chicago are cordially invited to make these offices their headquarters.

Railroad Inspection Car.

A new type of gasolene engined railroad inspection car is shown in our illustration. The car is similar in general construction to the former Oldsmobile railroad inspection car, with the exception of having an arrangement of seats behind, which gives it a capacity of from six to eight persons. The car is so designed as to permit of these extra seats being removed and replaced by a platform which will carry men, tools and material for ordinary railroad repair work. The car is driven by a 7 h. p. gasolene motor, and has a speed possibility of from thirty to thirty-five miles per hour, and which is, however, variable and always under perfect control. The engine and gearing are the same as used in the ordinary road automobile.

The car is built for standard gauge tracks, has sixty-two-inch wheel base, oak sills, 20-in. pressed steel wheels, cold-rolled steel axles, roller bearing and powerful brakes of the expanding clutch type. These cars carry water and gasolene sufficient to run them one hundred miles or more, while the cost of operating is very slight since a gallon of gasolene is sufficient to run them twenty to twenty-five miles.

One of these cars has been used more than three thousand miles on a prominent railroad system where there are grades as high as 3 per cent. and has demonstrated its capability by ascending these grades at a satisfactory speed with a full load. From a full stop on a maximum grade the car quickly develops a speed of twenty miles per hour. In operating the car backward it is geared to run at about one-half its forward speed. The Railway Appliances Company, of Chicago, will be happy to give inquirers further information about these cars.



RAILROAD INSPECTION CAR.

Phosphor Bronze is one of the best bearing metals used by railroad companies, and makes a very uniform glossy surface that runs cool under circumstances where other bearing metals would produce a hot box. The proper composition is 78.72 per cent. copper, 10.58 per cent. tin, 9.79 per cent. lead, 1.04 per cent. phosphorus. While the original phosphor bronze is excellent the remelted bearing is liable to give trouble. In the remelted phosphor bronze bearing there are likely to be hard streaks that can scarcely be cut by a file. These streaks play the mischief with journals.

Mr. Waitt as a Railway Specialist.

The following are extracts from a personal letter addressed to the chief editor from our friend Mr. A. M. Waitt, formerly superintendent of motive power on the Lake Shore and on the New York Central. Among other things Mr. Waitt says:

"It will doubtless interest you to know that I have just opened offices at 17 Battery Place, New York, as consulting engineer, using with the title a sub-heading, 'Railway Specialist,' as I prefer, as far as possible, to specialize my efforts in the general lines of investigation and thought that I have pursued for twenty-five years past. The scope of work that I am prepared to undertake can perhaps be best shown by quoting from a recent letter to a prominent business friend:

"'I believe that twenty-five years in the railroad service, and especially the past fifteen years of it, during which time I have been in general charge of mechanical department matters on the Lake Shore and the New York Central roads, has fitted me for consulting work in all matters pertaining to railway equipment, shops, machinery and tools, mechanical department organization, as well as the investigation of existing conditions in mechanical department matters and suggestions for improvement of the same. I shall also be in a position to give expert testimony in legal cases, where railway or other mechanical matters are involved. I shall be pleased, if opportunity offers, to associate myself in a permanent consulting capacity with railway or other companies desiring expert advice in mechanical department matters or in the investigating, handling and developing of mechanical devices or patents.'

"The study, supplemented by extensive personal observation, both in Europe and the United States, in connection with heavy electric traction as a substitute for steam, places me in a position to act in a consulting capacity for railway companies contemplating the electrification of any part of their lines. I shall also be pleased, where it is desired, to give time and thought to the selection and purchase of railway, or other lines of supplies for companies who desire an unprejudiced and experienced representative in such matters in New York. A telephone call to my office, 'Broad 434,' will always ascertain when I am likely to be there."

The Art of Nail Driving.

Theories are very good in their place, remarked the late F. J. Holloway, but they would not teach one how to drive a nail. Nothing but practice will do that, and even practice without thought will not accomplish it. You must have both combined. When you drive a nail in a board, what do you do? Do you trust to luck that the swinging hammer above your head shall come down in the right place? Do you concentrate your thoughts on the hammer circling in the air? No. You concentrate your thoughts and eyes square on the head of the nail you want to hit, and no matter where your hammer is or what curves it describes in the air, if your intense thought is on the spot where the blow should fall, there it will fall. If your thoughts wabble and are uncertain you will miss the nail or drive it sidewise.

Attractive.

The Smooth-On Manufacturing Company, of Jersey City, have sent us a little horseshoe magnet with its "keeper." This latter is the soft iron armature which is attracted to the poles of the magnet. There is with the magnet a small piece of Smooth-On iron cement sheet packing. The packing easily responds to the influence of the magnet, which shows that it contains a high percentage of Smooth-On. This sheet packing is a combination of rubber, iron-cement and Smooth-On, and is used for withstanding high temperatures and pressures. This little "outfit" is contained in a neat leather case, the flap of which buttons down like the fastener at the wrist of a glove. The little magnet can be made to do all kinds of amusing "stunts" about the office desk, such as picking up pins, tacks, pens, paper clips, etc. Any of these articles may be made to hang from the under side of, and moved about the surface of a piece of paper with the magnet on top. The Smooth-On people will be happy to send it to any engineer who writes to them for it and who encloses five cents for postage.

Each on Its Own Ground.

At the present moment the people who would like to see the electric locomotive in the forefront are conservative enough to acknowledge that the electric locomotive has a field of operation quite distinct from that which the steam locomotive can "make good."

The electric locomotive is the whole thing in difficult tunnel operation. It has there no climatic conditions to face which it cannot successfully deal with. It gives out no deadly gases as it goes along, and it can light up its right of way in superb style.

In suburban work with rush hour traffic the electric locomotive may almost be said to shine, or it eventually will shine, if you prefer the expression. Many trains, short headway, quick movement, is where the electric locomotive gets in its fine work.

On long hauls, with heavy trains, in the open, against all kinds of weather, the electric locomotive is not making any derogatory remarks about the old-fashioned steam locomotive, because each is minding its own business.

The Mallet Compound at Work.

The articulated compound freight locomotive of the Baltimore & Ohio Railroad, which is the only one of the Mallet type in this country, was first placed in active service, Jan. 5, 1905, helping freight trains over the grade from Sand Patch to Rockwood, on the Connellsville Division, a distance of 16 miles. The Baltimore & Ohio Railroad had this powerful locomotive built at the Schenectady works of the American Locomotive Company. An official test run was made between Cumberland and Hyndman, 14 miles, which was successful. Sand Patch is 33 miles west of Cumberland, and from there to Rockwood the grade ranges from 1.3 to nearly 2 per cent. The heaviest grade is at the rate of about 1,000 ft. to the mile. This locomotive was built for "pusher service," and is used to help freight trains over Sand Patch Hill, on the Alleghany mountains.

It is, in fact, a pair of locomotives with one boiler. The engine, in working order, weighs 334,500 lbs., and the weight of the tender filled with 7,000 gallons of water and 13 tons of coal is 143,000 lbs. It has the greatest heating surface ever put into a locomotive —5,586 sq. ft., of which 219.4 sq. ft. are in the fire box, and 5,366.3 sq. ft. in the tubes, which latter are 21 ft. long. The power of the locomotive in drawbar pull is 70,000 lbs. working compound, or 80,000 lbs. in simple gear. The boiler will carry a working pressure of 235 lbs. The engine was fully illustrated and described in the June, 1904, issue of RAILWAY AND LOCOMOTIVE ENGINEERING.

We have received a finely illustrated descriptive pamphlet which makes us think of Chicago and Milwaukee as two cities within easy distance of Joliet. We have always thought of Joliet as a place where many people were trying to keep away from, as it contains a particularly commodious penitentiary, but the Citizens' Alliance people, who sent out the pamphlet referred to, say that Joliet is an excellent manufacturing city, and a good location for new industries.

A "WESTERNER," BUILT AT THE UNION PACIFIC SHOPS, OMAHA—THE MODERN POWER FOR MOVING FREIGHT ON THE PRAIRIE.

New Signal System.

The Southern Pacific Company are reported to be experimenting with a system of train protection devised by W. W. Piddington and C. W. Mills, of Los Angeles.

It is known as the "three rail system." The third and center rail is constructed of wood, capped by two steel plates. The signals are operated by electric power, the dynamo being situated on the engine.

The power is constantly projected ahead in the center rail for a distance of a few miles, in which "zone," if anything is wrong, the engineer is immediately notified by the ringing of a gong and the lighting of a colored incandescent bulb in the cab. For instance, a yellow light means caution, a green one safety and a red one danger.

When the locomotive enters the same "zone" in which a station stands the operator is apprised by a bell. He can give his signals, to stop or not to stop for orders, to the engineer by pushing buttons on his desk.

Mr. Piddington, who is an electrician, and Mr. Mills, formerly a carpenter, have been working on the invention for the past two years, although it was not perfected until a short time ago.

A company, known as the Mills & Piddington Cab Signal System, has been incorporated for the purpose of promoting the invention. The officers are: C. W. Mills, president; H. T. Duff, vice-president; W. H. Sheasby, secretary and manager; S. B. Reynolds, general manager; C. E. Payne, treasurer; W. W. Piddington, electrical engineer; Robert N. Bulla, attorney, and G. C. DeGarmo and Elizabeth Mills, directors.

We receive a very great number of catalogues in this office from time to time, and among those devoted to steel castings of all kinds, the one we have just got from the American Steel Foundries, of 74 Broadway, New York, is perhaps the best record of a very wide range of work, and an exceedingly fine specimen of the printers' and engravers' arts. The catalogue deals, in its opening pages, with trucks and bolsters. A number of good half-tones and line cuts illustrate the various kinds made by this company. Next come couplers and coupler parts, fully illustrated and indexed, after which follow the wheels made by the American Steel Foundries. The latter part of the book, and the one containing the most variety, is that devoted to marine work. All sorts of odd-shaped, heavy steel castings are shown. The company produces open-hearth, cast steel by the basic and the acid processes. It also makes nickel steel and crucible steel castings. If you are interested enough to write them for a catalogue they will be glad to send you a copy of this interesting little book.

Water, Work and Winter.

The Pennsylvania has lately been hard pressed for water on the road and the East Altoona shops have experienced a shortage as well. The company appealed to the authorities of Hollidaysburg for sufficient water to run the shops and pointed out their own inability to cope with the situation. They further showed that if the shops were compelled to close down about 5,000 men would temporarily be thrown out of employment at a time when work was plenty and repairs urgent. The Hollidaysburgers, not relishing the enforced hollidaying of so many railroad employees agreed to let the railroad have the water necessary to tide them over the shortage and the shops continued to do business.

On the middle division, trains of tank cars, each tank containing about 10,000 gallons of water, were run daily. On the Pittsburgh division the water train drew its supply of H_2O from Grapeville, and, notwithstanding the name of the town, the water from that point made good extra dry, though unfermented steam, when boiled over a hot fire. Many of the sources of supply were frozen up and much delay and inconvenience was experienced in the thawing-out process, but the Hollidaysburg and Grapeville waters have stood the test all right.

Babbitt is a word that covers a multitude of sins of commission and omission. Cheap Babbitt metal is a mysterious mixture that a dealer will sometimes declare to be as good as any kind of anti-friction metal, but it generally consists largely of spelter. Genuine Babbitt metal is 80 per cent. tin, 10 per cent. antimony and 10 per cent copper. It pays every time to buy the genuine article.

Improvements on the Southern Pacific.

Press dispatches say that the Southern Pacific will go in for a number of improvements this year, among which will be the laying of 2,500 miles of 80-lb. rails. Another important improvement will be the installation of 200 miles of track with block signals. The block system is known to increase the efficiency and capacity of any road using it and, moreover, its adoption is in accord with enlightened public sentiment.

This company has also decided to build some hospital cars which are to be turned out of the Sacramento shops. The cars will, of course, be at the disposal of the hospital department. Each car will be able to accommodate twelve injured persons. There will be a stateroom for doctors, a room for attendants, a kitchen, an operating room and lockers for medicines, surgical instruments, etc. Altogether, the cars will be complete in their equipment.

Judging from the improvements outlined above, the Southern Pacific intend to render the possibility of accident as remote as may be, yet the maintenance of hospital cars on their system is a thoroughly good exemplification of the old motto: "In peace, prepare."

A Clear Case.

A story is told of a speech recently made by an Irish barrister in a court of law. He was for the plaintiff, whose cow had been knocked down and killed by a train, and this was the contention: "If the train had been run as it should have been ran, or if the bell had been rung as it should have been rang, or if the whistle had been blown as it should have been blew, both of which they did neither, the cow would not have been injured when she was killed."—*London Tit-Bits.*

The Stephens & Coryell Valve Company, of Marietta, Ga., have sent us a folder which they have just got out. It describes their cut-off valve for dry-pipe heads. The object is to enable the engineer to shut off steam from either side of a locomotive in case of a breakdown. The handle of the valve comes up just behind the smoke-stack, and a sector with notches in it, locks the valve full open, or one side or the other shut, as the case may be. In fact, this device is simply a niggerhead or T with a hinged valve in it, which can be moved to left or right, as required. The T itself is made of cast iron and the valves and seats are of phosphor bronze, and the valve is self-adjusting on its seat. By the aid of this valve, the location of blows on one side or the other becomes an easy matter. The Atlanta & West Point Railway and the Western Railway of Alabama are having these valves put in some engines being repaired and built at the Rogers Locomotive Works, at Paterson, N. J.

The Lehigh Valley Railroad Company have a practice of presenting an annual pass good over all the system to employees who have nothing against their record for ten years.

Structural Steel Tie.

A novel railroad steel tie has lately made its appearance. It is made out of a rolled section, a steel T, in fact, with the web notched and cut in a particular way. Two tie plates are used with each tie, and the whole thing is complete without any spikes or clamps or fastenings of any kind, and the rails cannot become wide to gauge and they can not become tight unless some accident happens to the tie.

These ties are easily made, and are the product of the Avery Stamping Company. The web is cut to the required shape by a special shearing machine, and the tie plates are readily stamped and bent to the required shape. The steel tie is no doubt more expensive than the wooden tie as far as first cost is concerned, but the steel tie will outlast the wooden one and has not to be chemically treated in order to do it; and when the steel tie has served its purpose the scrap it worth something.

Rails, ties and tie-plates go together very expeditiously and lock securely, and that eliminates a lot of time in track work and maintenance is improved. In shipping over the road more steel ties than wooden can be sent in any one car, which, of course, is an economy.

Steel Tubes on Scots Locomotives.

The following are extracts from a private letter received from Mr. John F. McIntosh, locomotive superintendent of the Caledonian Railway, Glasgow. As British railways used brass and copper tubes almost exclusively until quite recently, the information imparted will be of interest to many of our boiler users:

A great many railway companies are now using steel tubes. In some cases they braze copper ends on the steel tubes before putting them into the boilers and do this several times until the tubes are completely worn out. The nature of the water on our line is very detrimental to steel, as it causes corrosion and pitting. For a long time we used nothing but red metal tubes, that is, a tube with about 90 per cent. of copper, and we kept brazing them at the ends to maintain them to their original length until they became so light and they had to be scraped. Since the introduction of long boilers, however, we find that the red metal tube is rather heavy and inclined to break off at the tube plate. Consequently for some years back we have used galvanized steel tubes, the process of galvanizing assisting materially to prevent the tubes from deteriorating or pitting, and although they have been at work for only a comparatively short time, still I am in hopes that the results obtained will justify the experiment. There is no doubt a nice soft steel tube is far superior to either brass or red metal if it is not affected by the water.

Asleep at his post from long hours of work, Engineer Cosgrove was severely hurt in the wreck of two Walhonding Valley freights on the Pan Handle tracks, ten miles east of Coshocton, O., December 15. Cosgrove had the second section of some coal empties and the flagman from the front section, seeing no heed paid to his signals, threw his lantern into the cab window as the train sped by. Cosgrove awoke and reversed his lever, but too late to prevent the crash that sent seven cars off the track and burned the caboose. He leaped and was badly hurt. This is a story too often told. How many fatal wrecks are caused by overworked trainmen.

The Pressed Steel Car Company, of Pittsburgh, Pa., has been awarded by the St. Louis Exposition Committee a grand prize for the perfection attained in the manufacture of steel cars at its McKees Rocks plant.

The American Locomotive Company has presented to Purdue University, Lafayette, Indiana, the full-sized model locomotive cylinders sectioned to show the piston valve construction, which formed a part of its exhibit at the Louisiana Purchase Exposition.

ADVANCED METHOD OF REMOVING GERMS AND DUST FROM RAILWAY CARS.

The management of the Central Railroad of New Jersey has made another step of advancement through the recent installation of a system of car cleaning which has the universal approval of the health authorities along its line, and as it is practically the first transportation company to adopt it, the method may be of interest to our readers.

The old method of car cleaning, with a whisk here and a dash there with a broom or duster, was not only unsanitary, but unsatisfactory, for the reason that it had the effect largely of removing dust and dirt from one section and depositing it elsewhere; but under the new method, which is termed the "Vacuum Sweeping System," the dirt and dust is drawn from the car by suction through a pipe, and is gone forever. The New Jersey Central has erected an immense vacuum plant in its Jersey City yards, and for a distance of 3,600 feet has laid pipe varying from two to five inches in diameter, covering in all about three miles. At short intervals this pipe is tapped, and from these cocks is run the flexible hose, which may be taken in the car either by door or window. At the foot of the hose is a metal pipe with a flat triangular end, along the base of which is an opening, and through which the dust and dirt is drawn by the Vacuum or "drawing-in machine" located a distance away. The operator runs the slot opening over the cushions, carpets, curtains, wood-work, etc., and without any commotion or dust raising, every loose particle or germ is whisked away, everything being left clean and wholesome. The dust thus removed, before reaching the great "drawing-in machine" must pass through two dust separators, the first of which clears the air of 90 per cent. of the grit, dust and germs; the second separator or cylinder draws the air through water in which corrosive sublimate is used, and completes perfectly the purification. The New Jersey Central management has for a long time felt the necessity for a more sanitary method of car cleaning, and the Vacuum System, while reducing disease liabilities to a minimum, at the same time reduces the cost of cleaning and time consumed. Two cars can be thoroughly cleaned under the new system at the same expense of time and money as was formerly consumed in cleaning one, and this, in connection with the increased sanitary value, is sure to cause its general introduction within a short time, not only by other transportation companies, but by theaters, hotels, places of public resort and even the home.

The United States Circuit Court for the Western District of Pennsylvania, on January 3, 1905, entered an order dismissing the bill of complaint in the suit brought by James Pincin, of Altoona, Pa., against the American Locomotive Co., the Pittsburgh Locomotive Works and H. B. Ayers, general superintendent, and awarded costs to the defendants. This suit was brought on the Pincin patent, No. 719,133, dated January 27, 1903, which related to an eccentric having a two part wear ring secured to it by bolts and a two part bushing in the eccentric strap, and which was alleged to be infringed by H 6 A engines built for the Pennsylvania Lines by the Pittsburgh works of the American Locomotive Co.

The "R. A." or "Ajax" cotton belting vestibule diaphragm, as made by the Railway Appliances Company of Chicago and New York, is the subject of a folder which has lately been issued by that company. These diaphragms are rivited at the folds with brass rivets, which are japanned to prevent rust. The Ajax diaphragms are reinforced by a galvanized steel rod, which runs entirely around the diaphragm. This rod prevents the sagging of the material at the corners and top, so that it always keeps its appearance. A top shield or hood is also used, made of heavy enameled duck, for shedding water, cinders, etc. If you are interested write to the company for further particulars.

The number of railway accidents seems to be on the increase. During the year ending June 30, 1904, there were 3,367 railway employees killed and 33,711 injured. In the same time 420 passengers were killed and 81,077 injured. The increase in the number of deaths of passengers in train accidents in 1904, compared with 1903, is 64½ per cent. During the year there were over 6,000 train collisions.

We have all got to travel through Vanity Fair, and we had better learn the rules of the road from the best masters.—*L. H. M. Soulsby.*

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Railway and Locomotive Engineering

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Early Days on the Lackawanna.

BY ANGUS SINCLAIR.

In a previous article a description and illustration were given of the first locomotive used on the Morris & Essex Railroad, which afterwards became the eastern end of the Delaware, Lackawanna & Western Railroad. The Morris & Essex was not, however, the first built link of the Lackawanna chain.

OWEGO AND ITHACA RAILROAD.

The humble section of railroad which is the oldest of the scattered pieces that now constitute the trunk line and branches of the Delaware, Lackawanna & Western Railroad, originated through the ambition of two small towns to make themselves active factors on a great transportation chain. The towns were Owego on the Susquehanna river, and Ithaca, 34 miles distant, at the head of Cayuga lake. There must have been energetic business men in these two towns, for they schemed to join the waters of the Susquehanna and of Cayuga lake by a railroad, so that people and merchandise westward bound, could ascend the river to Owego, thence by rail to Ithaca, then down the lake to make whatever connection could be most easily established for Lake Ontario and the great western country then filling up with settlers.

The charter for the Owego & Ithaca Railroad was secured in 1828, being the second railroad charter granted by the New York Legislature, but the road was not built until 1832, a year after the Mohawk & Hudson Railroad was opened. The original intention was to operate the Owego & Ithaca Railroad by horses and two inclined planes, one at each end. This practice was followed for eight years till 1840, when a small Norris type of engine, called "Old Puff," built by Walter McQueen, at Albany, was put into service.

LEHIGH VALLEY OBSERVATION TRAIN, CAYUGA LAKE BOAT RACES.

The business anticipated for this road did not materialize, and it languished in financial difficulties till 1843, when it was reorganized into the Cayuga & Susquehanna Railroad, but the change of name did not bring prosperity. In 1849 it was incorporated into the Leggetts Gap Railroad, which inspired it with new life.

LEGGETTS GAP RAILROAD.

The Leggetts Gap Railroad was chartered in 1832 by a few enterprising men, whose ambition exceeded their financial ability, and the scheme languished until 1849, when it was taken up by a group of industrial giants who had settled in a mountain bounded valley known as Slocum's Hollow, where they built the city of Scranton. The mountains were covered with valuable timber and in the ground beneath were thick layers of anthracite waiting for capital and labor to convert it into fabulous riches.

Among the leaders who established homes in this valley, so favored by nature were George W. Scranton, Selden T. Scranton, William E. Dodge, Jeremiah Clark, Dr. Andrew Bedford, Henry W. Drinker, John J. Phelps and others, whose names ought to have a prominent place among the pioneers who converted the forests and wilds of America into fertile fields graced by homes redolent of comfort and refinement.

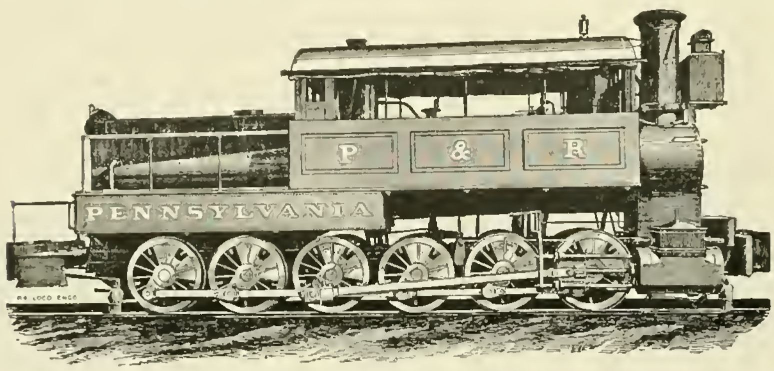
TRIUMPHS OF INDIVIDUAL ENERGY.

The strong individuality of Americans has frequently exercised very powerful influence on localities where men of indomitable will have been accidentally planted. Many towns and cities owe the fortune of rapid growth to a few pushing, energetic men, who happened to become interested when the character of the place was being established. On the other hand many locations whose surroundings favored for the making of prosperous cities linger in obscurity because the pioneers that controlled the fortunes of the place were "no account men."

Slocum Hollow was fortunate in the settlers it attracted at the crucial period. Colonel Scranton and his friends proceeded to put in operation iron works and a variety of industries that turned into marketable goods the raw material of the district. The products of the anthracite coal mines were also seeking customers. Then in course of time the leaders of the district went feeling for western markets, and in connection with such enterprises the Leggetts Gap Railroad which had been chartered seventeen years before, was in 1849 promptly built to connect with the Erie Railroad at Great Bend.

Leggetts Gap is a depression in the mountain about two miles north of Scranton, and was the natural pass for a railroad to escape from the valley. Shortly after the Leggetts Gap Railroad was completed the company was reorganized and became the Lackawanna & Western. As the controlling purpose of the company was to connect with the Erie Railroad the same track gauge of 6 ft. was established. The road when completed to Great Bend was 48½ miles long.

A considerable part of the construction work was done by horses and mules, but after a time the old Owego & Ithaca locomotive, Old Puff, was put into service, and then one of the old Braithwaite engines was purchased from the Philadelphia & Reading. In this connection it is a curious commentary on the brevity of our railroad history to tell that E. J. Rauch, the man who brought that engine from Reading and ran it for several years is still alive and in robust health.



ONE OF MILLHOLLAND'S DEVELOPMENTS. FIG. 82.

DOTTERER BECOMES SUPERINTENDENT.

About 1850 the Lackawanna & Western Railroad management engaged David H. Dotterer as superintendent and master mechanic. He had been for several years engaged in the building of rolling mill machinery at Reading, Pa., and like most engineering concerns of the day built locomotives when orders could be secured. Although it was apparent that the carrying of anthracite would constitute an important part of the railroad company's business, Mr. Dotterer ordered wood burners for the train service which was commenced shortly after his appointment. The first new engine purchased was a Rogers eight-wheeler with outside cylinders 16x24 ins., and driving wheels 5 ft. diameter. Then orders were given to the same firm for some ten-wheel engines inside connected and they were delivered before the passenger engines. Orders were given later for engines from various makers, among them Danforth & Cooke, the New Jersey Locomotive Company, Ross Winans and others.

ANTHRACITE-BURNING ENGINES ORDERED.

About 1853 the management of the Lackawanna & Western wanted their freight locomotives to burn anthracite. The first coal burning engine received was almost a reproduction of Millholland's "Pawnee" class illustrated on page 439 of last year's volume of RAILWAY AND LOCOMOTIVE ENGINEERING. It had six wheels connected and one pair of small leading wheels behind the cylinders, and the peculiar boiler already described.

The engine was built by Danforth & Cooke under the supervision of Watts Cooke, who afterwards gained celebrity as a mechanical engineer. He was appointed master mechanic of the Lackawanna & Western a few months after the engine was finished. He was assigned the task of taking it from Paterson to Great Bend by the Erie.

THE WINDING ERIE.

One of the leading engineers engaged on the location of the Erie held that curves on the track were things of beauty. The country through which the Erie runs from Paterson to the Susquehanna river provides ample occasion for curved track. When natural inequalities were made the best use of by an engineer, with an animosity to tangents, there were ample opportunities for making a very crooked track. The wheel base of the "Anthracite," as this engine was called, was equivalent to that of an eight-wheel connection. It was not adapted for passing the sharp curves of the Erie, and the men in charge went through great tribulations in making the trip, as derailments were very frequent. The journey of 184 miles took about a week.

The Lackawanna was by no means a straight line in its course through the mountains of Pennsylvania, but it was not so bad as the Erie. Watts Cooke, however, concluded that it would be an improvement to convert the "Anthracite" into a ten wheeler, and that was done.

ROSS WINANS SUPPLIES ANTHRACITE COAL BURNERS.

The "Anthracite" was not a success as a hard coal burner, but that did not discourage the management. Ross Winans, who was generally in evidence when a difficult problem in locomotive engineering was to be solved, succeeded in selling to the Lackawanna people a camel engine with elongated fire boxes, which burned hard coal very successfully. This engine weighed about 56,000 pounds and had cylinders 22x22 ins., and four pairs of cast-iron wheels 43 ins. diameter, with no truck. This engine hauled heavy coal trains at slow speed quite satisfactorily. The result was that five other Winans engines were purchased.

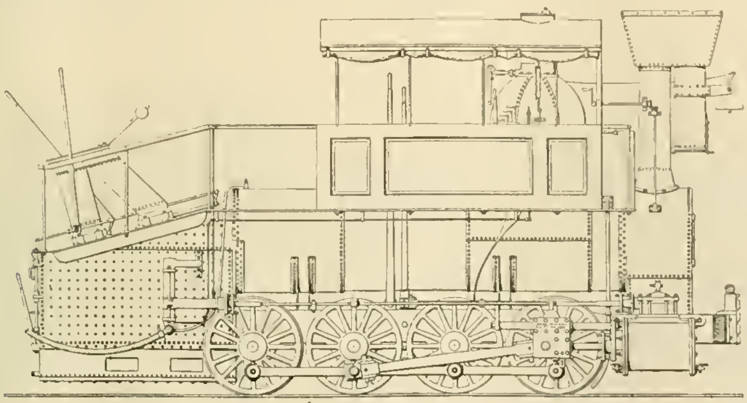
These Winans camels were unpopular with the engineers, who did not take kindly to setting on the top of the boiler. They were all scrapped in 1859 on account of boilers not being considered safe.

In 1854 when the New Jersey Locomotive Company were invited to build coal-burning engines for the Lackawanna road, Zerah Colburn was designer and mechanical engineer for the locomotive builders. Colburn was one of the most celebrated men the United States has nurtured. Some of the engines which he designed were masterpieces of advanced locomotive engineering.

ZERAH COLBURN.

Zerah Colburn was born on a farm near Saratoga Springs, N. Y., in 1832. His father died during the son's infancy and the mother removed to a small farm in New Hampshire, where Zerah spent his boyhood taking his share in helping with the farm work even at an early age. The first education he received was at the common school of the district where his mother's farm was located. The book training was very meager but Zerah had within himself the attributes that attract knowledge from all the surroundings, in which the individual may be placed.

He had a strong bent towards mechanical pursuits which landed him in the Lowell Machine Shops as an apprentice when he was 15 years old. These, originally the Locks & Canal Works, were the oldest locomotive building establishment in New England. Little is known of young Colburn's oppportunities in the Lowell works, but it is certain that within a few years he became one of the most expert draughtsmen in the United States. For a time he worked in the machine shops of the Concord Railroad, then he went to Souther's locomotive building works, where he was for a time superintendent. Several other positions he filled with much credit as mechanical engineer, but his fame rests on his literary ability and his achievements as a writer on mechanical subjects. When little more than a boy, Colburn began writing articles to the current technical journals about the work he was engaged on. These soon began to attract attention through their elegance of diction and lucidity of description. He was an excellent mechanic and a very accomplished draughtsman, but the consciousness grew gradually upon him that writing was his forte, and engineering journalism became his life's work. A peculiarity of Colburn's writings was that he made stories about engineering details read like interesting works of the imagination. His articles and books educated people into the practice of reading with pleasure technical literature.



ROSS WINANS CARBON FOR D., L. & W. FIG. 83.

Colburn's principal literary labors were editing *Colburn's Railway Advocate*, editing the *Engineer*, of London, originating the *Engineer*, of Philadelphia, and in originating and editing London *Engineering*. The most permanent monument of his genius and industry, however, is his book on "Locomotive Engineering and the Mechanism of Railways."

The success of a man like Colburn ought to be an inspiration to boys who have to make their own way in the world. See him a farm boy moved by an inner pressure toward a wider life. See the boy working in the machine shop during the day and at night burning the midnight oil over the drawing board, training his hand to the touch of an artist draughtsman, and reading the select literature that made this engineering editor a wonder among the masters of classic English.

Zerah Colburn had an uncle of the same name, who was a famous mathematician. People writing about the famous engineer and editors have frequently confused his work with that done by his uncle.

COLBURN'S WIDE FIRE BOX ENGINES.

As a journalist Colburn devoted much attention to the operating of the locomotives in different sections of the country and his analytical mind busied itself with the causes of the diverse performances of the locomotives in use. The experience he had and the experiments he was able to carry out convinced Colburn that most of the American locomotives suffered from too limited grate surface. While holding the position of mechanical engineer with the New Jersey Locomotive Company he turned his attention to enlarging the fire boxes, a move he had strongly advocated in his writings. He had a group of engines built for a railroad in Canada with fire boxes wider than the track gauge. Assured by the success of these engines he then designed some engines for the Lackawanna with fire boxes 7 ft. 6 ins. wide and 6 ft. long, providing 45 square feet of grate area.

These engines as originally designed are illustrated in Figs. 84 and 85. They were very powerful engines for the time, having cylinders 18x24 ins., and a boiler with ample heating surface to supply the cylinders with steam.

About the time that they were ready to begin building the engines, Mr. Colburn left the New Jersey Transportation Company and the builders changed the design somewhat, for one thing shortening the fire box to 4½ ft. and putting in a combustion chamber. John Brandt was then superintendent of the works. The engine as delivered to the Lackawanna in 1855 had cylinders 18x24 ins., six coupled driving wheels, 4 ft. diameter, straight boiler, 50 ins. diameter, with dome 30 ins. diameter, and 28 ins. high. The fire box was 7½ ft. wide, 4½ ft. long, and had combustion chamber 4 ft. long. The flues were 3 ins. diameter and 10 ft. long. The material used in construction was lighter, the shell having been made of iron 28 in. thick, and fire box of ¼ in. iron.

After considerable experimenting this engine was changed, the fire box having been lengthened to 6 ft., and 2½ in. tubes substituted for the larger size. A variable exhaust was applied, consisting of a plug which could be raised or lowered from the cab. Mr. Henry F. Colvin, of the Rue Manufacturing Company, Philadelphia, ran one of the engines for some time, and he states that it did not steam satisfactorily until the fire box was lengthened to the size originally designed by Colburn.

Colburn's "Lehigh" was not any more popular with the locomotive department than were those built by Winans. A departure from established forms always excites prejudice among enginemen. Five more of them were ordered, but they never became popular. Long fire boxes were applied to them, the Lehigh having been changed in 1863, and the others afterwards.

QUESTION OF WHO ORIGINATED THE WIDE FIRE BOX.

A historical question is involved as to how far Colburn's form of boiler and fire box influenced the design of the Wootten fire box and of other similar forms without combustion chambers. Many of the wide fire box engines in use to-day are what the Colburn fire box would have been with the frames carried back under the fire box and the latter spread over the driving wheels.

In regard to the influence which the Colburn fire box exerted on the development of the Wootten and so-called "Mother Hubbard" fire boxes, I place a high opinion on the views of Mr. Henry F. Colvin, who was an engineer on the Lackawanna and ran several of the engines with the Colburn fire box. Mr. Colvin writes us:

"There is no doubt in my mind that Colburn's wide fire box was an important factor in the introduction of the wide fire box now so generally used on the Delaware, Lackawanna & Western and other railroads. The only objection to the original Colburn fire box was that it did not allow for a decent arrangement of coupling the engine to the tender, and the overhang caused a tendency to 'wobble' the engine while running. While I was running the "Investigator,' which had a Colburn fire box, Watts Cooke, the master mechanic, had several talks with me about this very matter, and he could not see any way to overcome the long coupling bar.

"After the present type of fire box had been adopted, I was in the shop at Scranton and saw my old friend William Connell, who was then general foreman. He asked me to go into the boiler shop to see a new kind of boiler that was being made. On the way we met James Hughes, foreman of the boiler shop, who said they were making a new boiler for the 'Investigator,' and that it had the old Colburn style of fire box without a combustion chamber."

Mr. J. Snowden Bell, Patent Attorney at Pittsburgh, who is very well acquainted with the development of the locomotive, thinks that Mr. Wootten was influenced more by the Millholland than the Colburn form of fire box when working out his designs.

SOUTHERN EXTENSION OF THE LACKAWANNA.

Writing the history of any particular railroad is not the purpose of these articles beyond what its influence may have been on the development of the locomotive engine; but it may be mentioned that the promoters of the Lackawanna Railroad were not long satisfied to have their outlet restricted to the West. After several years of agitation, work on a southern extension was begun in 1853. The enterprise was of an exceedingly formidable character, for the towering Mount Pocono barred the way almost at the beginning, and that was followed by trackless forests through a savagely broken country to the Delaware river. The Warren Railroad, 21 miles long, was utilized to make connection with the Central Railroad of New Jersey at Bridgeville, and for a time this was the route followed to the Atlantic seaboard.

At the time the southern extension was undertaken, the Lackawanna became the Delaware, Lackawanna & Western Railroad. In 1868 this company secured control of the Morris & Essex Railroad, and thereby obtained direct connection with the Hudson river.

EFFICIENT DANFORTH & COOKE ENGINES.

Returning to the locomotive development on the Lackawanna system: The Lehigh was followed by the "Delaware," received in 1855, from Danforth & Cooke. The boiler was 48 ins. diameter and had a dome 32 ins. diameter and 34 ins. high; fire box 5 ft. long and 6 ft. wide, with a combustion chamber 42 ins. long, flues $2\frac{1}{2}$ ins. diameter. The cylinders were 18x24 ins., three pairs of coupled wheels 4 ft. diameter, and no truck. The valves were between the cylinders and were operated direct, transmission bars from the links spanning the forward axle.

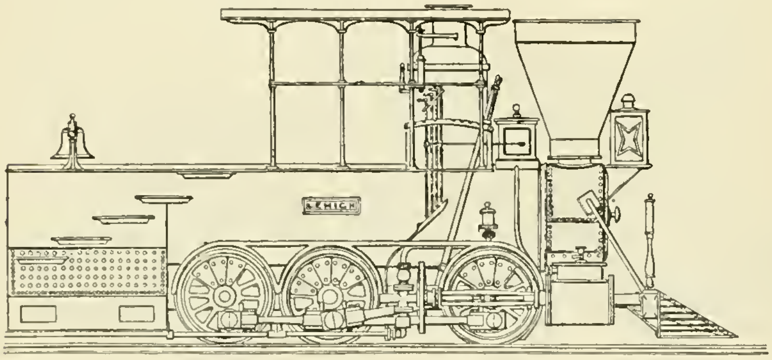
During 1855-6 five more hard coal burning engines were received from the New Jersey Locomotive & Machine Company that were very nearly the same type as the Lehigh. Then came the "Black Hawk," built by Danforth & Cooke, which was similar to the Delaware with a few would-be improvements added. There was a mid-feather in the fire box similar to that used by McConnell, of the London & Northwestern Railway, and illustrated on page 347 of RAILWAY AND LOCOMOTIVE ENGINEERING for 1904. There was also a combustion chamber, on each side of which were arranged air holes, made by inserting a short piece of 2-inch tube from the shell of the boiler. These air holes were arranged in a horizontal line about 3 ins. apart, having a frame around them with a damper in the form of a slide with holes to correspond with the air tube openings. This arrangement was intended to let in the air necessary to complete combustion, the damper being the keystone of the invention.

AN "IMPROVED" BOILER.

The engine proved to be the best steamer on the road, and it was supposed that a new era in coal burning had arrived. One of the first things the engineers learned in handling this engine was to keep the air tube dampers closed tight all the time. To admit air was to dampen the free steaming. Very soon the dampers fell into innocuous desuetude, and their connections were removed.

Then the mild-feather began to leak and it was removed as an experiment, and a patch was put over the crown sheet opening with square-headed tap bolts for convenience in taking out when a new mid-feather was ready. The engine went out on the road for trial and steamed as well as it did with the mid-feather on, so it ran that way for eight years, till the fire box had to be renewed.

In 1857 Danforth & Cooke delivered two more engines to the company that resembled the Black Hawk without the "improvements," but with the boilers lengthened to get a four-wheel truck under the smoke box, making them ten-wheelers. These engines proved entirely satisfactory so far as steaming was concerned, the only weak point about them being the arrangement for coupling the



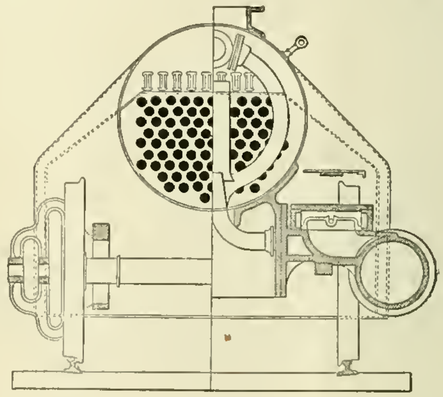


FIG. 84. COLBURN'S WIDE FIRE BOX ENGINE. FIG. 85.

tender. They ran many years before being modernized and there have not been any engines built since that showed more economy of fuel.

I am indebted to Henry F. Colvin for the facts about these engines.

An Africander Pacific.

The engine here illustrated is a Central South African machine, though one would have to look long and hard to find what road she belonged to. The name is there, however, and it surrounds the figures 600 on the small plate on the side of the cab. The engine was built by the Vulcan Foundry in England. It is a 4-6-2 or Pacific type, and is what they call in the dark continent an engine of the ninth class.

The cylinders are 18x26 ins., and the driving wheels are 57 ins. in diameter, and the engine has a tractive effort of about 23,600 pounds. Screw reversing gear is used, and the sand box is carried underneath the boiler and is operated by compressed air pressure. The weight of the whole machine is 60 tons, 7 cwt. and 3 qtrs. The tender weights 48 tons, 18 cwt. and 3 qtrs, making a total of 109 tons, 6 cwt. and 2 qtrs. A long ton of 2,240 pounds is used in thus describing the weight and 112 pounds is, of course, the hundredweight in this case.

The boiler is a straight top one and the heating surface is 1,481 sq. ft. in all, being made up of 1,350 sq. ft. in the tubes and 131 sq. ft. in the fire box. The grate area is 21¾ sq. ft. The pressure of steam carried is 200 pounds per sq. in. The capacity of the tender is 4,000 Imperial gallons of water which equals about 4,800 U. S. gallons, and 10 long tons of coal, which amounts to 22,400 pounds.

The design of the engine is severely plain, but the headlight and the pilot add familiar American details to its decidedly English appearance. We are indebted to Mr. P. A. Hyde, locomotive superintendent of the Central South African Railways for the photograph from which our half-tone is made, and for the data concerning the engine.

Philip A. Hyde, Locomotive Superintendent. A CENTRAL SOUTH AFRICAN 4-6-2. Vulcan Foundry, England, Builders.

To Build the "Stourbridge Lion."

It would be an interesting relic to have the "Stourbridge Lion," the first locomotive to turn a wheel in this country, set up as it worked when turned out by the builders. There is some hope of this being accomplished by one of our oldest and most enterprising citizens.

Mr. Charles Law, of Pittston, who long has been a leading figure in the anthracite region, says that he has one mission in life which he is anxious to fulfil, and on which he is now working. It is to get together all the original parts of the Stourbridge Lion, the first locomotive used in America.

"I can well remember the time when the Lion came to Honesdale," he said, in speaking of his mission, "and I saw it daily for nearly all the time it was in use. It was not used long. It proved too heavy for the rails, and was finally run into a shed and remained there for twenty years. Then it was taken apart and people who wanted parts for souvenirs took them.

"The main part is in the National Museum at Washington, but there are parts scattered all over the country. I have now managed to find each one of these parts. I know where every portion of the old engine is, and I have secured the promise of some owners to present the relics to the Government. Others are averse, however, to giving up what they possess, and I am now trying to overcome these objections. I hope to live long enough to get the old engine together once more."

Demand for Steam Turbines.

The General Electric Company find the demand for Curtis steam turbines so great that they have decided to devote an entire building to the construction of that type of engine.

Several advantages are claimed for turbines over reciprocating engines for driving electric machinery, among them small floor space per kilowatt capacity, reducing to a minimum the cost of real estate and buildings; uniform angular velocity, thus facilitating the synchronizing and paralleling of alternators; simplicity in operation and low expense attending; entire freedom from vibration, and approximate noiselessness; small oil consumption; high steam economy at all loads; high steam economy with rapidly fluctuating loads; steam economy not appreciably impaired by wear or lack of adjustment in long service; turbine adapted to high steam pressure and high superheat without practical difficulty and with consequent improvement in economy; condensed water is kept entirely free from oil and can be returned to the boilers; ability to use steam from any stage of the turbine for heating, without the troubles that such use on a large scale brings with compound reciprocating engines.

Your conscience must be a light to you, but it cannot be a law to others.

To Tell Speed of Trains.

Inquiry is frequently made as to how the speed of a train may be estimated. The traveler especially is curious about the speed his train is making, and we suggest three methods by which the speed may be guessed with remarkable accuracy, as follows:

1. Watch for the passage of the train by the large white mile posts with black figures upon them, and divide 3,600 by the time in seconds between posts; the result is the speed in miles per hour.

2. Listen attentively until the ear distinguishes the click, click, click of the wheel as it passes a rail joint. The number of clicks upon one side of the car in twenty seconds is the speed in miles per hour, where the rails are thirty feet in length, and this is the case generally.

3. Count the number of telegraph poles passed in two minutes, if there are four or five wires to a pole, and in two minutes and twenty seconds, if there are only one or two lines per pole, the number of poles passed is the number of miles per hour at which the train is traveling.

Handling Railroad Scrap.

The important fact, that with the exception of very few articles, all scrap that accumulates on a railroad has a market value, was strongly brought out by Mr. W. G. Tubby, the general storekeeper of the Great Northern Railway, in a paper recently read before the North-West Railway Club.

Mr. Tubby went on to show that this being the case, it is only common sense to turn this scrap into money with the least possible delay. On the Great Northern system scrap is handed over to the store department where second hand material is taken into store, material that can be repaired is taken to the shops and the rest is graded and placed in bins ready for sale.

The labor charge for handling scrap is comparatively expensive, because the work of sorting is necessarily slow. All scrap is turned over to the store department, practically as soon as it is made, and the proper accounts are credited with the value of the old material as fast as it comes in. Maintenance of way scrap that has accumulated during the month at the section tool houses is picked up by the store department supply cars. Scrap brass is delivered by the mechanical department with a credit ticket for each delivery. On receipt of the scrap brass at the storehouse it is weighed, graded and put into bins which are under lock and key.

Heavy scrap from the machine shop and all from the blacksmith and boiler shops is loaded onto cars specially assigned for scrap service. Credit tickets are made out and sent to the store department, and the cars are placed beside the scrap bins to be unloaded, sorted and graded, the credit tickets are checked up, the proper accounts credited for the month in which the delivery was made. In this way no scrap is left scattered around the shops or the grounds.

The section men have been educated to sort out the different kinds of scrap, so that when the supply car comes all maintenance of way scrap, except old rails, is quickly weighed, and the credit tickets made in duplicate are OK'd by the section foreman and the supply car man; one goes to the division superintendent and the other to the storekeeper. In this way no misunderstanding or confusion arises. The store department insists that, as far as practicable, old tools shall be turned in as scrap when new ones of the same kind are issued.

To handle scrap economically, a suitable set of bins should be provided, and the speaker recommended that the floor of the bins should be on a level with the deck of cars, and the bins should be made of ample capacity. The bins on the Great Northern are 600 ft. long by 38 ft. wide, which includes a platform on one side 8 ft. wide on which is placed a standard gauge track for the operation of push cars, which are used for conveying the different kinds of scrap to the proper bins. On this platform, in front of the bins, are two track scales on which is weighed the scrap in the push cars. On the opposite side of the bins there is a track where cars are placed for loading scrap when it has been sold. There is no platform on that side and consequently there is no lost ground to travel over in loading up, and the whole forms a handy and economical arrangement.

Fast Time for Bees.

There is a bee ranch with more than a million bees in the heart of one of the densest residence districts of San Francisco. It is owned by Philip Prior, principal of a public school, and is in the little back yard of his home. For ten years he has kept his bees there, has harvested about a third of a ton of honey each season, and has been at no expense for food for his interesting and industrious pets.

Although it is a distance of two and a half miles from the Prior bee ranch to Golden Gate Park, the Prior bees make the trip there, collect loads of honey and get back to the hive in two minutes, making a bullet-like flight at the surprising rate of 150 miles an hour.

Mr. Prior has demonstrated this by having an observer watch certain bee-favored places in the park, and exactly timing the arrival there of bees he purposely sprinkled with flour as they issued from a hive. He has also kept time on the absence of the whitened bees.—*Chicago News.*

Baltimore & Ohio Improvements.

President Murray, of the Baltimore & Ohio Railroad, has an aggressive policy and believes that to give the public the best facilities results in the most successful operation of a railroad system. Having spent over $100,000,000 during the past seven years in reducing grades, taking out curves, laying new track and improving terminals, it has been decided to provide up-to-date stations at many of the small places along lines of the road.

The erection of sixty new stations and the building of extensions to ten others has been authorized at an aggregate expenditure of about $80,000. The cost of each improvement will range from $250 to $1,500. The new stations will be located at different points along lines of the road where box cars and worn out old buildings have been in use. A number of them will be combined freight and passenger stations, and others will be used exclusively for handling freight. Some are in course of construction and contracts for others will soon be awarded.

To Control Trains by Telephone.

An ingenious system of keeping control of trains by telephone has been patented by Edward Rowe, a resident of Pennsylvania. We believe that the proper way to control trains is by block signals, but it is interesting to read how some people propose performing the same functions.

The Rowe system consists of a telephone in the engine cab and in the office of the block operator. The office telephone is connected at all times with a wire running from one end of the block to the other on the telegraph poles. At quarter mile intervals contact rails are placed on the ties just outside the roadway rails. These contact rails are blocks of wood with a sheet steel or iron covering. They are connected with the wire on the poles. The engines are equipped with a telephone instrument with the wires leading to a brush on the outside of the engine, so placed as to run on the contact rails.

As the engine passes each contact rail the contact is recorded on an indicator in the operator's office and shows how far the train has progressed. If the operator desires to talk to the engineer, all that is needful is for him to switch on a stronger current, which will ring the bell of the telephone instrument in the cab. The engineer will stop his train and back up to the contact rail, when he can talk to the operator. It is possible also for him to lift the telephone instrument from its hooks and carry it to the nearest contact rail, in case the engine should be disabled. The failure of the contacts to be recorded in due time would mean, barring the ordinary chance for the electric apparatus being out of repair, that an accident had happened. It would then be possible for the operator to catch any oncoming train inside of a quarter of a mile and avoid accident.

Motive Power Men and Duties.

We have noticed for years that when Robert Quayle, superintendent of motive power of the Chicago & Northwestern Railway, rises to speak he always has something to say that is worth listening to and worth reporting. Some one has been kind enough to send us a copy of *The Iowa Engineer*, containing an address delivered by Mr. Quayle on Motive Power, and our only regret is that its length prevents us from sharing with our readers the whole enjoyment we derived from reading it.

The first portion of the address was devoted to telling about the progress made by the Chicago & Northwestern Railway, then he discussed present railway equipment with that of thirty years ago; the effects of increased tonnage; the shopman's work and how small savings count; economy of standardizing machinery; consumption of fuel, with various prospects of its reduction; safety appliances and other topics. Then he went on:

In 1874 we used to think our freight trains were running at a very high rate of speed if they were making 15 miles, and our passenger trains were scheduled at about 20 miles per hour. To-day our freight trains frequently make twice the speed our passenger trains used to make, and our passenger trains are scheduled anywhere from 40 to 60 miles per hour, which means, in order that the schedule time may be made, where conditions are favorable, that we must often make 70 or more miles per hour, to make the time. This increased speed is due to the desire of the American people to "get there," and they are constantly demanding of the railroad companies a faster service, and these new conditions demanded by the public have only been made possible by the use of the quick action and high speed brakes, and every car and engine of the train braked.

The motive power departments to-day, particularly those that have a large suburban service to conduct, will have to consider, no doubt, in the future, the problems of steam vs. electric locomotives or gasoline locomotives, which are becoming quite a feature in transportation circles, and the motive power man that is not alive to these subjects to-day will wake up some morning to find that he is a back number. This presents a very large field to the mechanical and electrical engineer, and while the electric service is still in its infancy, and largely experimental, the electric interurban lines have proved beyond a doubt in the last few years, the success of operating good sized trains electrically over long distances. The gasoline engine, as applied to interurban service, is a new feature, and is not yet developed, but is being considered by some of the railroads throughout the country, and we will watch with interest the development of this type of motor for light suburban and branch line service.

Other matters are before us, not the least important being the locomotive terminal. Thirty years ago the total length of the locomotives in service was from 40 to 45 ft. over all. This, you can see, means that our terminals have to be changed to meet the new conditions, when you will understand that the modern locomotives of to-day range from 70 to 75 ft. over all. Without giving this any consideration you will see at once that this means new engine houses, also new turntables. It means longer storage tracks outside, and when you consider that the locomotives of 30 years ago took but five to six tons of coal, and that now we have to put on from 10 to 14 tons of coal, it will be apparent that our coaling facilities have changed very materially, and in considering the future, we are constantly asking ourselves the question: "Will the growth in the next 30 years be equal to the growth of the last 30 years?" and at the period of which I speak, it might be well to call attention to the cars, which, at that time, were not able to carry more than ten tons, while to-day the cars they are building vary anywhere from 30 tons to 50 tons.

It used to be the practice that every man would have a regular engine, and the engine remained at the terminal until the engineer and fireman assigned to that engine had sufficient rest, and were ready to go out again. To-day it is not a good thing to keep engines waiting for men, as there is too much money invested in them, and that amount of capital has to be kept moving all the time, in order that we may be able to get returns from the money invested. Therefore, when the engine comes in, it is the business of the roundhouse foreman to see to it that the fire in the fire box is properly cleaned, that the engine has coal, sand and water, and that all necessary repairs are made, and the engine turned round and started out just as quickly as they are called for by the operating department.

TWO CYLINDER COMPOUND MOGUL, NORWEGIAN STATE RAILWAYS. WITH WALSCHAERT VALVE MOTION.

The roundhouse foreman is a very busy man, particularly where he has 100 or more engines coming into his terminal every day.

It is his duty to see that every engine is properly inspected and that whatever repairs are reported by the inspector and locomotive engineer who brought the engine in, are properly made, and the engine put in safe running condition to make the next terminal, at least.

It is also his duty to keep the master mechanic advised of the condition of the engine, so that the master mechanic may make arrangements with the proper official whose duty it is to see that the engines are placed in the shops for general repairs, after they have made sufficient mileage, or at least know that the engines are in such condition as not to warrant keeping them in service any longer.

It is the duty of the master mechanic of each division to forward to the assistant superintendent of motive power, a condition report of the locomotive that he intends to send into the shops, with the mileage of the engine given. Each shop should have a schedule of time that the engine should be in undergoing the needed repairs. If the engine needs heavy or general repairs, or new fire box and general repairs, each shop should have a fixed time in which this work is to be finished, and every department in the shops should be acquainted with the date that the engine comes in, the length of time the engine is to be in, and the date the engine is expected to be out, so that the head of each department, then, will know when he must have all the work he will have to do for that locomotive completed, and the locomotive finished within the specified time.

To accomplish, however, the best results in our shop practice, it is necessary that the shop foremen should be thoroughly organized, and that each man should know all about the system or systems introduced, and should be made familiar with the needs of every other department by frequent meetings with the superintendent of the shops, and when, by this means, every shop foreman knows the requirements of every other foreman, it makes him a better man in his own department, and a better man so far as the total results are concerned.

It is good practice, at the meetings of the foremen, to discuss with them their methods of doing work, and it should be the duty of one or two of the officials to constantly look up new and improved methods and new and improved machinery, in order that they may keep abreast of the times, and this can be done best by the official whose duty it is to watch that kind of work, not only to read all the current literature bearing on such subjects of to-day, but he should visit, frequently, the progressive shops of the country, and see what the best practice is in every department, and then introduce that practice to the head of his shop at headquarters, and see if, through the intelligence they have in these shops, they cannot improve on the best practice of other shops, then to bring in the foremen and master mechanics of outside points to headquarters and show them what we have that is new, and encourage them to go back to their respective shops and improve on that, and in this way there is a spirit of friendly rivalry established which the company gets the benefit of.

There is more to be gained by the education of each man in charge of each shop than is at first thought possible. Master mechanics and others who have, by years of experience, forged their way to the front are sometimes inclined to think that the young man should grasp the situation and accomplish just as much as the man who has had 20 or 30 more years of experience, and he does not stop to think that he, as master mechanic of the division, should encourage the young man by pointing out to him the many ways wherein the young man could make improvement. Sometimes by asking a single question: "Why do you do this work in this manner?" and follow up his reply by asking another question: "Can you not think of a better way of doing this; a way that will get out more work with the same man and the same tools in the same time?" This will set the young man to thinking, and it is only as we get men to thinking can we expect to get improved results.

You know that as individuals we get into ruts and unless somebody takes us by some means and lifts us out of the rut, we are liable to continue there, and it would be the duty of every motive power official to have every other man under him consider the ruts we are in to-day, and how we can get out of them, and in getting out of them accomplish more for the company we serve.

After all, the personal equation of the mechanical staff on a large railroad is not much unlike the young men in our State institutions of learning. It is apparent to you that young men come to this school with a view of extending their knowledge, and thereby enhancing their value, but after all, is it not a fact that it is not knowledge that enhances their value, but the proper application of that knowledge to the work that they have in hand? Therefore, the successful man of to-day in railroad life as in commercial or educational life is the man who is competent to get out of the men that are working with him the very best that the men are capable of giving. We need men who can carry a message to Garcia. To you that needs no further explanation.

You young men are laying the foundation stones of a superstructure that will be what you make it. When you will have finished your education you will only have laid the foundation, and after you leave the college halls and go out into the world and are thrown upon your own resources, you will then have to build the superstructure, and it will entirely depend upon how you use the knowledge you have gained here, and how you will appropriate it to your own good as to the results that you will obtain for yourselves as individuals, bearing in mind that to be successful you must consider that your time must not be wasted; that your efforts must be on intelligent lines; that your aims and ideals must be high, and then put forth with all your might your every effort to reach those ideals.

Gasolene Cars for Surface Railroads.

A statement is going the round of the general press to the effect that the American Locomotive Company is building one of the promised revolutionary locomotives. The paragraph usually reads:

"The American Locomotive Company will build the trucks and frame work of the first of the new style of internal combustion locomotives which is to be assembled at the Corliss works of Providence, R. I. The General Electric Company will supply the electrical parts. This new engine is fireless, smokeless and uses no water or coal. A combination of compressed air, fuel-oil, and electrical power produces the motive power. It is being built for the Southern Pacific, for test purposes, and if successful may revolutionize locomotive construction. The designers claim that this engine can haul a 2,000 ton train from New York to San Francisco without a stop."

The fire causing all this smoke is that the American Locomotive Company's engineers are working on the designs of an internal combustion locomotive for surface railway short trip business, but the scheme is yet in embryo. The idea is to design a powerful gasolene motor car that can be used either as a power for hauling other cars or for carrying a load of passengers as trolley cars do. We believe that a motor car of this kind could be made which would be very useful where passenger traffic is light.

For several years past a considerable part of the coal used by the Philadelphia & Reading Railroad has been bituminous coal. Orders have now been issued by President Baer to return to the exclusive use of anthracite. This move has come about through the small sizes of anthracite having become a glut upon the market.

In a composition written by a little school girl in Boston, she says: "In beginning a railway journey, you have to get a ticket, which is a piece of paper, and you give it to a man who cuts a hole in it and lets you pass through."

"Man is like an ash can," says a school boy's piece. "He standeth forth in the morning light, strong and full of grit. And Fate, the garbage man, cometh along and emptieth him to the winds, and rendeth him in divers places and chucketh him into the gutter."

New Franklin Air Compressor.

Our illustration shows one of the air compressors recently furnished to the Pennsylvania Railroad for their new shops at Altoona, Pa. The compressors have compound steam and compound air cylinders, and are designed to run non-condensing with a boiler pressure of 100 pounds. The high and low pressure steam cylinders are 11 ins. and 20 ins. in diameter, respectively, and the air cylinders are 11 ins. and 18 ins. with a stroke of 24 ins. The capacity of each compressor is 700 cu. ft. of free air at a speed of 100 revolutions per minute.

All bearings are of large proportions, a fact which will be appreciated by those who have had experience with air compressors. All the bearings are provided with removable shells or bronze bushings having provision for taking up wear.

The steam cylinders are provided with Meyer adjustable cut-off valves, and the main steam valves are double, ported, thus admitting of short ports and small clearance. The high and low pressure main steam valves are efficiently balanced.

Both air cylinders are provided with mechanically operated inlet valves of the Corliss type, which are placed in cylinder heads admitting of close clearance and large port area with consequent free admission of air. These valves are actuated by the steam cut-off eccentrics, so that four eccentrics drive both steam and air valves.

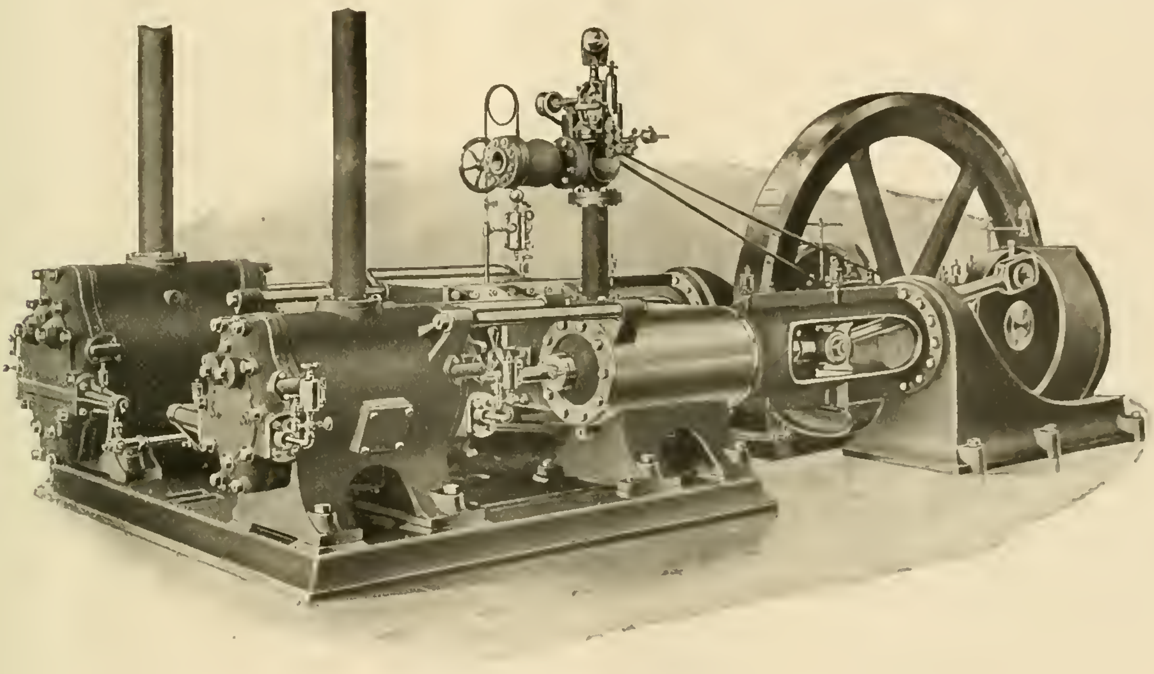
The discharge valves are of the poppet type, the valves proper being cup shaped, pressed out of sheet steel.

An intercooler is provided, which cools the air after compression in low pressure cylinder, down to the temperature of the atmosphere. This intercooler being self-contained can be placed in any desired location.

Owing to the small diameter of the cylinders and the long stroke, the percentage of clearance in air and steam cylinders is small, resulting in high efficiency and economy of steam.

The governor is furnished with a regulator which brings the machine to a stop when receiver pressure has reached the desired amount. The governor automatically starts the compressor upon a slight drop in receiver pressure. The governor is also supplied with a safety stop which acts in case of accident to the governor belt. A rigid box-section sole plate extends under the four cylinders to which they are securely doweled. This feature is a help in setting the machine and in maintaining its alignment.

Further information may be obtained from the Chicago Pneumatic Tool Company, makers of the machines, either at their offices in the Fisher Building, Chicago, or at 95 Liberty street, New York.



NEW DESIGN OF FRANKLIN AIR COMPRESSOR.

To Erect Model Tenement Houses.

In London and other large European cities certain rich persons have effected great good in the congested districts by erecting improved tenement buildings a live charity that has been engaged in very rarely in America. We are pleased to learn that Henry Phipps, the rich Pittsburgh steel maker, has planned to give $1,000,000 for the erection of improved tenements. It is Mr. Phipps' purpose to form an organization to carry out the work. He will probably be president, Isador Strauss vice-president, and Mr. De Forest chairman of the executive committee. Besides Mayor McClellan, who will be an ex-officio member, the trustees will be Messrs. De Forest and Strauss, John W. Arbuckle, Alfred T. White, Myles Tierney, Charles S. Brown, Dr. E. R. L. Gould, W. S. Hawk, Charles A. Moore, George E. Gordon, John S. Phipps, and Charles Stewart Smith. Four of the trustees, Messrs. De Forest, White, Tierney, and Brown, were members of the New York State Tenement House Commission of 1900, which framed the present law. Dr. Gould is president of the City and Suburban Homes Company, which builds model tenements.

Didn't Know What Struck Him.

He was hanging rather limp over the rail of a New York Subway car, making a strenuous, overworked effort to expectorate. That he had imbibed too freely of the beverage which made a certain western city famous, was quite evident. He was equally oblivious of the close proximity of the highly-charged third rail and the fact that moisture is a good conductor of the electric current. The thick saliva hung pendulum-like from the mouth of the intoxicated man, and finally came in contact with the third-rail. The result was magical. A bright blue thread of flame traversed the pendulum, striking the inebriated man square in the mouth. The shock dumped him in a heap on the platform. He was dazed, but instantly sobered. As the guard assisted him to his feet, he spat out several teeth and mumbled something about not remembering "drinkin' that blue stuff with teeth in it."

Hard Thinking.

I have often wondered if the royal roads to learning mechanical trades, which are so numerous now a days, can dispense with the "horse sense" that used to help men over the difficulties presented by inferrior tools and few of them. It should be the province of colleges and especially technical schools, so to train the minds of their students, that not relying on the theories or formulas alone, they will so use them in connection with thought that they shall become aids only in the accomplishment of what has to be done.

There is no education that can supplant thinking in the making of a successful engineer. To think out a problem is the only true way to successfully solve it. Do the elaborated conveniences for performing every mechanical operation give the same scope to the thinking faculties that devising means to accomplish our end did? The manufacturer has benefited from the increase of tools, but the workman has lost. Nothing of experience can ever take the place of hard thinking. The contribution of schools, laboratories, libraries, lectures and manual practice will be most valued when supplemented by hard thinking.

Thieves Trying to Rob Through the Panama Canal.

If any of our readers happen to see a newspaper advertisement reading, "Wanted: Men for the Panama Canal," they will better refrain from spending $1.00 in the attempt to secure such a job. There are a certain class of harpies who are pretending to be agents for securing men to work on the Panama Canal. Their first requirement is a registration fee of $5.00 from every applicant. When the Government wants men to go to the Panama Canal, there will be no mistake concerning the inducements offered. People will not have to pay any money to register. The same may be said about the Panama Railroad Company. A gang of very enterprising thieves is working up this means of obtaining money under false pretenses in New York City and we are sorry to learn that they have found that kind of swindling to be quite remunerative.

The 4-4-2 Type Popular Abroad.

A good example of how the locomotive nomenclature which we use on this side of the big pond is becoming popular in Great Britain may be found in the fact that the London *Chronicle* describes the fine engines which work the "Scotsman" express as belonging to the "Atlantic" type. This train leaves Kings-cross station in London at 10 A. M. and makes the first part of the trip to Edinburgh in a run to Doncaster, 156¼ miles, at the rate of about 60 miles an hour. These 4-4-2 engines have a total heating surface of 2,500 sq. ft. and driving wheels 78 ins. in diameter.

On the Chemin de Fer du Nord (Northern Railway of France) our English contemporary speaks of a run made from Amiens to Paris, a distance of 82 miles, in 80 minutes. The engine doing this was an "Atlantic" type built after designs by the well-known French engineer, M. de Glehn, who, by the way, is of English birth. It is a similar engine to this one which the Great Western Railway of England have had built for trial upon their lines. The de Glehn engine is a compound with 2,325 sq. ft. of heating surface and 80½-in. driving wheels. The foreigner is called "La France" and is competing against a fine specimen, the "Albion," turned out of the Great Western company's locomotive shops at Swindon.

Train Assailed by a Rhinoceros.

A collision recently occurred on the Uganda Railway, British East Africa, that would be possible nowhere else on earth. A huge bull rhinoceros rushed out of the bush and charged at full speed the so-called "up-mixed" train, which was slowing down as it approached the station Sultan Hamoud, 218 miles from Mombasa. The train was stopped, and the "rhino" was discovered about 100 yards down the track. Slowly he returned to the jungle, and was lost to sight. He did not escape unharmed, for pieces of his thick skin were found adhering to the train, but the fierceness of his assault smashed the engine step and splintered the inch and a half footboard of the first carriage.

A rhinoceros is an animal that once ruined the faith of a little Sunday school boy. While the menagerie procession was passing through the town the rhinoceros opened his dreadful mouth. The boy exclaimed: "Mamma, did God make that thing?" "Yes, my son," was the reply. "Keep still." "Well," protested the boy, "if God made that thing I'm not going back to Sunday school."

Station Loafer Causes Murderous Collision.

A striking instance of how railway companies are sometimes saddled with the ignomy and cost of train accidents was well illustrated last Christmas morning. On the St. Louis Division of the Southern Railway there is a small station called Brown's Crossing, which is sometimes used as a meeting point. On Christmas morning this agent had received orders to hold No. 1, an eastbound train, and had set the red signal for the train to stop. As the train was nearing the station, the agent went along the platform to look after some baggage, and while he was away a meddling loafer pulled the signal connection, changing red to white. The engineer seeing the clear signal ran past without stopping and had a butting collision with the passenger train that he was to meet on the hold order. The result was nine persons killed and about 20 injured, some of them very severely.

That loafer who turned the signal ought to pass the remainder of his days in a prison cell, but the chances are that he will escape proper punishment so that irresponsible idiots may do likewise. Many railway stations are infested with lazy loafers whose hands are never out of mischief or pilfering. Their presence at such places is a menace to life and property. There is too much important mechanism about the stations and on track nowadays to have people lounging about who cannot keep their hands off. If unauthorized persons were strictly kept off tracks and out of station houses there would be much fewer accidents charged against American railway companies. The voices of public opinion are ready enough to shout blame against railway companies when accidents happen; but they are persistently mute and hard to rouse when called upon to help in establishing methods of prevention.

Interstate Commerce Commission Asks More Power.

The annual report of the interstate commerce commission, aside from its statistical features, is a plain statement of the evils and injustice of the present system of railway management in the United States.

The report shows the inadequacy of present laws. It shows the wrongs worked to shippers under the private freight car system. It shows the injustice resulting from terminal railroads owned or controlled by favored shippers.

The exactions of the railway and the helplessness of the shipper are brought out in marked contrast, and the remedy is plainly stated. The report declares, in so many words, that Congress should give the Interstate Commerce Commission power to fix joint through rates over connecting and continuous lines.

"Go on with your blasted old train; you can't kill me!" shouted a Gloucester man, as he crawled out of a snowbank, to the engineer of an express that had struck him. That was his first thought. Perhaps he will wish, after he has been seen by a lawyer, that he had thought twice before speaking. Under such conditions it is always wise to remember the possibilities of a damage suit.

General Correspondence.

Some Causes of Railway Accidents.

Editor:

All my study of railway accidents as reported in the United States and Europe arrives at precisely the same conclusion as your editorial that:

"Block signals, perfect brakes and strong cars will reduce the fatalities of collisions, but the real remedy is to cultivate obedience to constituted authority."

In other words, breaches of rules, carelessness, recklessness and incompetence are at the bottom of 99 out of every 100 accidents in railway travel.

But less than one-quarter of the accidents charged against American railways occur in travel—the vast majority being incident to an industrial pursuit. This distinction is preserved in England and ignored in America, where the totals are paraded to inflame popular animosity against the railways.

I have not pretended that mileage is an accurate basis for comparing the relative possibilities of accidents on English and American railways, except that it happens to represent in an approximate way the average of the sum of the differences between the passenger and ton mileage—in other words the traffic units—of the two countries. We carry passengers an average of 30 miles and freight an average of 131 miles in this country to seven and 35 miles respectively in Great Britain. These two factors alone represent a far greater difference in the opportunities for an accident than that existing between the mileage of the two countries.

I notice that you say that "mileage does not necessarily increase the chances of accidents," but elsewhere you admit that "running into an open switch is one of the most fertile causes of fatal accidents in railroad operation."

Switches multiply with mileage; we have the switches necessary to operating 211,000 miles in a territory of 3,000,000 square miles; they have the switches necessary to operating only 22,000 miles in a territory of 120,000 square miles. The difference in the number I do not know, but the Interstate Commerce Commission reports that in 1903 we had 61,560 miles of yard track and sidings, or nearly three times as much as the total single track mileage of the British roads, and nearly seven times the total of British sidings (9,363 miles).

The trouble with the accident statistics of the Interstate Commerce Commission is that they are barren figures and are not directed to a sincere endeavor to ascertain the causes of those accidents. I have always approved of the installation of block signals, but to be effective they should be attended with more exacting discipline and not a relaxation of discipline which operating officials report as the tendency of their introduction.

The manual system is universal in England, and its success depends on an approach to automatic observance of rules which seems impossible with the more independent and venturesome American railway employee. This and the high cost of labor in the United States accounts for our trying to find a substitute in automatic contrivances for the manual methods adopted across the water.

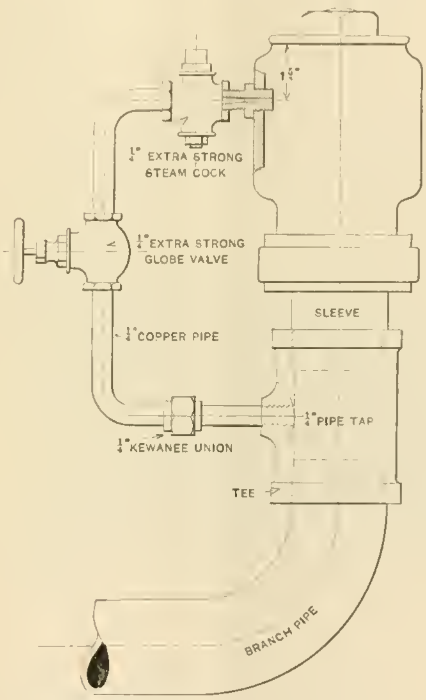
SLASON THOMPSON.

Chicago, Feb. 6, 1905.

Automatic Heater for Injector Feed Pipes.

Editor:

During a recent tour of roundhouses in Chicago, with the thermometer below zero, I found several engines whose injector connections were frozen solid after the engines had been delivered to the charge of the roundhouse force. Primarily the object of my trip was to find out what devices were being used to overcome this vexatious evil, so as to give the readers of RAILWAY AND LOCOMOTIVE ENGINEERING the benefit of any new wrinkles. My quest was eminently successful, as I found what I went after on the Burlington, and through the kindness of Mr. Clark, Superintendent of Motive Power, was favored with a blue print of the device.



HEATER FOR BOILER CHECK.

As shown in the illustration, the device can be applied to any boiler check and operates automatically. In order to get the necessary pressure to operate the heater, a small union stud with a 3-16-in. opening at the check end and reduced to 1-16-in. at the other end is firmly secured to the shell of the check valve casing and sufficiently high above the check valve proper to prevent interference.

As a precautionary measure an extra strong steam cock is secured to the stud which closes communication with the heater pipe in case of the globe valve midway between the piping becoming disarranged. From the globe valve the piping leads to the delivery pipe below the check valve. During the winter months when there is danger from freezing, both the steam cock and globe valve are kept open continuously, and when for any reason the injector is shut off, this device, taking its pressure at once from the boiler, carries the steam and hot water to the delivery and feed pipes. It also removes one of the numerous cares from the engineer's mind, as he has only to satisfy himself before starting on his trip that the by-pass valve is open.

This device has proved very satisfactory since its introduction by the Burlington, since its first failure has yet to be recorded.

During the summer months the valves are closed or removed from the engine.

This device, the Burlington advises me, is not patented, and anyone is at liberty to use it.

JOS. A. BAKER.

Popular Fallacies.

Editor:

That a train composed of loads and empties requires more power to haul it when the loads are on the rear end.

That when water is so low as to endanger crown sheet, it is a wise plan to open throttle wide, and place lever on center, while engine is standing, until water is again restored to the desired level.

That the forward damper must be used when going ahead, and the rear one when backing any distance, in order to supply sufficient air under grates to insure steaming of engine.

That the left side of engine usually

pounds more than the right side because of engineers' habitual neglect of left side.

That engines will sometimes steam well for a few miles, then steam poorly for a distance, and then steam all right again; all in the same trip with no change of fuel or other conditions.

That under any conditions engines will slip their driving wheels when steam is shut off.

That an engine after receiving an overhauling is not as good as before going to shop because lever cannot be worked so close to center as before while doing the same work.

That it is an advantage to have reach rod lengthened so engine will work stronger with lever at short cut-off position.

That more lead is what is needed to make all engines "smarter."

That leaky steam pipes don't affect the steaming of engine unless the blow is of sufficient force to impede the draft by blowing in the opposite direction to it.

That flat driving wheels are caused by imperfect counterbalancing, or that depressions on rails is due to the same cause.

That at very high speed the counterbalance causes driving wheels to raise from rail.

That the practice of throttling an engine is conducive to economy or efficiency of service, or that the use of a full throttle causes engine to "choke."

That when an engineer sees an obstruction on the track he cannot avoid striking, it is the part of wisdom, or is the general practice to "throw on" full steam and increase the speed so as to throw the object clear, thus avoiding damage to or possible derailment of his train. There have been some cases of this kind, but the best that can be said of them is, "All's well that ends well."

That boiler explosions are occasionally caused by some mysterious agency, or that they are frequently the result of low water.

That injecting "cold water" into a boiler when water in boiler is below the crown sheet will cause a boiler explosion.

Some of the foregoing fallacies have taken deep root in the lay mind, while others have as yet a firm hold in the minds of many members of the craft; having been handed down as valuable information to aspiring youth by former generations; but when exposed to the rays of that great searchlight, RAILWAY AND LOCOMOTIVE ENGINEERING, the gloom of mystery and doubt that befogs our minds is gradually vanishing, and its readers, or at least those who earnestly avail themselves of its aid, are learning to accept nothing for truth that is not supported by sound reasoning.

T. P. WHELAN.

[As a whole the points on popular fallacies are good, but we think our correspondent is mistaken when he classes as a fallacy the belief that the counter balance sometimes raises the driving wheels from the rail. That such a thing happens was demonstrated in experiments made on the locomotive testing plant at Purdue University.—ED.]

Is a Locomotive More Powerful in Forward Than in Back Motion?

Editor:

Quite a discussion has been carried on for some time past over a question which all agree to leave to you to decide. Your reply will, therefore, place a number of officers and employees your debtors.

Question: Is a steam locomotive stronger in the "go ahead" or the "back up" motion?

The fact that pressure on the piston is greater when steam is taken through the front port than when taken through the back port, owing to the space in the cylinder occupied by the piston rod, is admitted. The point in question is, whether more power is required to move the drivers when the crank pins are below the center than when above the center.

Also: An engine moving forward takes steam through the forward ports while the crank pins are below the center and, therefore, gets full pressure on the piston while the drivers are in that position. An engine moving backward takes steam through the forward ports while the crank pins are above the center, and, therefore, gets full pressure on the piston while the drivers are in that position. While an engine is taking steam at the front port the force is "pushing," and while taking steam at the back port the force is "pulling."

The question resolves itself to this: Can an engine start a heavier train forward than it can backward while the crank pins are above the center, also when the crank pins are below the center?

I hope you will not publish this letter, or at least use any names in connection with it, but any published statement or any direct reply will be highly appreciated by our superintendent, by our master mechanic and others, and by chief train dispatcher.

Answer: When the valves are set so that the mean effective pressure of steam will be the same when the engine is working in back gear as it is when working in forward gear, the rotative effort on the driving wheels will be the same. The action of a piston transmitting power for turning a crank is not perceptibly different in pushing from what it is in pulling. The action of the working forces are not different in turning a driving wheel than they are in turning the crank of a stationary engine. Nearly all horizontal stationary engines are driven with the crank moving in the same way as a locomotive is when running backward.

Locomotives are sometimes less efficient in backing than they are in pulling, because the valves are not set so well as they are for forward gear. It is a common thing to sacrifice accuracy of cut-off or even admission in back gear to make the forward gear as nearly right as possible. That, of course, interferes with the hauling capacity of locomotives in back gear.—ED.

The "Monkey Motion"—Another Attempt to Revolutionize the Locomotive.

Editor:

Enclosed herewith clipping from this morning's *Call*. This may be of interest.

For your information, would state that Mr. Luckett was for many years the general foreman at Sacramento, and the engine referred to is probably an improvement on the old "monkey motion," which was invented many years ago by Mr. A. J. Stevens. He built a large number of these engines and they were a splendid valve motion—many of them are running to-day on the Mountain Divisions in California. The only thing against them is that they are more expensive to make than the ordinary link motion engine.

I am a constant reader of your paper, buying it every month from the news stands, and I hope the information given above will be of interest.

FRANK M. LELAND.

Here is the clipping referred to by Mr. Leland:

"A new type of engine, known as the "monkey motion" pattern, which, it is claimed, will revolutionize steam locomotion on railroads, was successfully operated on the Southern Pacific tracks to-day, when a train of 1,500 tons was run from Ogden to Wadsworth, Nev., hauled by one of the new engines.

"The new type of engine was designed by Edgar M. Luckett, of the Southern Pacific. Many advantages over the standard type are claimed for the "monkey motion." All the driving mechanism is located on the sides of the engine, making it easy of access. The steam exhausts very rapidly and there is no back pressure.

"It is estimated that the new engine will save from 25 to 40 per cent. in coal consumption, being able to run fifty-four miles with one ton of coal, as against twenty-five to twenty-eight miles under the present system. The standard engines now in use can be changed to the "monkey motion" with but very little cost."

The Stevens valve motion referred to in the above letter, known among trainmen as the "monkey motion," was an improvement on the Walschaert valve motion and was highly efficient, but not particularly more so than a good link motion. The improvements effected by Mr. Luckett may have decided merit, but they are not likely to revolutionize the steam locomotive. Revolutionists who labor on the locomotive generally find her in the old condition when they have finished wasting their efforts.—Ed.

Refinements of Locomotive Management.

Editor:

There are times in the experience of all men, including engineers and firemen, when information of a purely elementary character would help them over a difficulty, while the most learned dissertation on theoretical problems would only mystify, for the moment. and be the reverse of helpful. Knowing this as I do from experience, I will offer a few suggestions which I am certain will be helpful to many young engineers and some older ones.

Properly throttling an engine is economical practice. An engine cut back to a very short cutoff working at high speed may have pressure in steam chest constantly, or almost constantly, higher than boiler pressure, due to lead and compression, in which case lubricator will not feed oil to valves; but oil will be held in pipes above steam chest, and the valve face and seat becoming dry much power is lost on account of excessive friction. This is indicated by hard handling of the reverse lever, and by a rattling and jerking of reach rod and reverse lever. When this condition arises, ease in throttle slightly for a moment, which will allow oil in pipes to flow down into steam chest and lubricate the valve. To avoid this condition entirely, under ordinary conditions of load, engine should be carefully throttled without losing efficiency in any way, and by doing so you save power otherwise lost in friction of an imperfectly lubricated valve. This is one advantage of judicious throttling.

Again, we want a given amount of power to do a given amount of work in order to make time with a train. With a full throttle the lever may have to be hooked up to a 4-inch cutoff in order to regulate the work of the engine, in which case loss will occur because of excessive cylinder condensation, and this aggravates the trouble occasioned by poor lubrication, for the wet steam caused by excessive expansion and consequent reduction of temperature causing it to condense in cylinders, in its passage from cylinders through exhaust passages to the atmosphere washes the oil from valve faces, thus aggravating the trouble already existing on account of oil not being properly supplied to them.

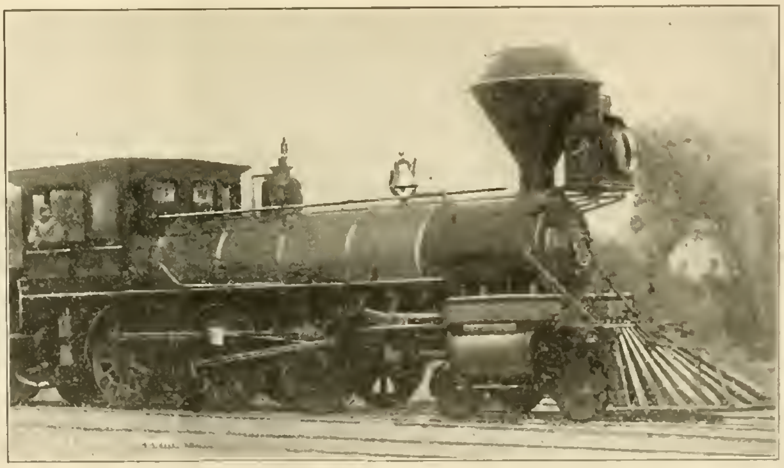
Properly throttling an engine requires more skill and experience than most young engineers possess. One must have the faculty of "feeling" of his engine, and to a man who can do this a locomotive is as obedient and responsive to his manipulation as a well-trained horse is to the rein. This gift comes by study and practice, and cannot be acquired but by careful and intelligent effort.

My advice to a young engineer who has not acquired the nice skill and judgment to enable him to throttle an engine scientifically, would be to try to approximate the correct method in the following manner, and if he has not already done so he will be surprised at the result in economy, and better handling of his engine. After train is started, place reverse lever in same notch as when full throttle is used, and where it will do the required work. Then ease in on throttle until the effect is just perceptible. Then if you pursue this policy with care and judgment you will have no trouble with valves from causes mentioned. With engines having finely notched quadrants the utmost nicety of judgment in regulating cutoff may be employed. It can be done by anyone who will study the machine and the action of steam in imparting its energy to the engine. It may be best in many cases to guard against too short cutoff, but a very little judgment will enable one to avoid this. Too much throttling is a greater evil than too short cutoff. Saturated steam has no heat to spare, hence when wire drawn so that initial expansion takes place in dry pipe and steam passages power is lost. because the steam has lessened capacity for expansion in cylinder where it should be made to do work. Then the temperature of steam is reduced with its pressure, consequently wiredrawing causes excessive condensation, as it is loss of heat that causes condensation. When steam is wire drawn to cylinders, in order to get what I may call normal work out of engine a long cutoff is required, so that admitting steam at low pressure, and admitting during a longer period of the stroke we get less reduction of pressure by expansion, hence high terminal pressure which causes excessive back pressure and a "fierce" exhaust which tears the fire, wears out the fireman, causes waste of fuel in generating steam which is thrown away and gives engineer and fireman or both a bad reputation for economy and efficiency. Study the exhaust of your engine. If you will it will tell you in a language plain and clear when you are right and when wrong. A tremendous exhaust does not tell a story of work being done, but of energy wasted.

Wm. Westerfield.

Mt. Carmel, Ill.

[Mr. Westerfield's ideas about using steam are on the whole sound, but he may be a little off on the effects of throttling. Under ordinary conditions throttling leads to superheating instead of condensation of the steam.—Ed.]



OLD STEVENS ENGINE WITH "MONKEY MOTION."

That Forward Center Pound.

Editor:

On page 23, of the January number, the question is again asked: "Why is it that an engine pounds harder when passing the forward center than when passing the back center?"

You quote Mr. J. M. Foster's answer, which assumes that the backward thrust of the piston, main rod, and loose box is a backward movement of these parts independent of the forward movement of other parts of the engine, and that the heavier pound occurring at or near this part of the stroke is due to the encounter of these two movements.

There seems to be something wrong with this assumption. All the parts of the locomotive would seem to be possessed of inertia irrespective of the movements of these parts relative to each other. If the inertia of the reciprocating parts does change with respect to the frame it could not be with the suddenness indicated by Mr. Foster's reasoning. The inertia of the reciprocating parts is greater than the frame on the forward stroke and less than the frame on the back stroke, the greater inertia gradually diminishing as the pin nears the forward center, and the lesser inertia gradually increasing as the pin nears the back center. Snap judgment would probably conclude that the thrust of the piston backward would "come up against the advancing pedestal" with greater force than the piston would pull the box forward up against the pedestal getting away from it. To see the fallacy of this reasoning carry the idea a little farther and consider the force which causes the thrust and pull of the piston. When the thrust of the piston is backward, when pound is said to be greatest, the steam pressure is between piston and cylinder head which is getting away from it. When box is pulled ahead steam pressure is between piston and "advancing" back cylinder head. See article, "Why a locomotive moves," page 834, October, 1896. Also that part of article, "Why the locomotive moves," on page 409, September, 1899. (This latter article is well worth repeating at least once a year.)

"Kicking a man coming toward you and one running away," is not a parallel case. You might get between two men in a baggage car, when speed is uniform, one toward the front of the car and the other toward the rear, and see if you cannot run ahead and kick the forward one just as hard as you can run back and kick the rear one. Or see if there is any appreciable difference in the force required to tip a trunk toward the forward end of the car or toward the rear.

The principal cause, however, will probably be found in the other idea which Mr. Foster advances when he refers to the wheel being "slid backward on the rail." The wheel hesitates about sliding until sufficient force accumulates to overcome the friction between the wheel and the rail when it goes with a "slam." On the back center the "box or journal is pulled up to its place with the rolling of the wheel."

The other pound which Mr. Foster refers to on page 213, May, 1903, is explained very clearly by Mr. T. P. Whelan on page 209, May, 1899, but incorrectly explained on page 221, May, 1903.

H. A. Burke.

Tacoma, Wash.

Simplicity and plainness are the soul of elegance.—*Old Curiosity Shop.*

Annual Dinner of the Erie Railroad Association.

Connected with the Erie Railroad there is an organization called the Erie Railroad Association, composed of officials belonging to all departments and located all over the great system. The Association is composed of about 300 members, most of them energetic, pushing young men, who are working their way upwards, familiarity with the duties of their various positions being the motive power by which they are striving to make their mark on the railroad world.

The original purpose of this association was to bring the members into closer touch with each other that the company they serve might be the gainer from the esprit de corps cultivated by increase of personal intercourse. The fact of the members belonging to a social association of this character has a binding effect that spreads fraternal feeling, which is always in evidence with the same kind of bond that draws Free Masons and other fraternal organizations together.

Once a year the Erie Railroad Association meets together around the festive board, and the men who during the remainder of the year know each other only through reports and correspondence grasp hands, look each other in the eyes, pledge each other in cups of kindness and dispel all the clouds of uncharitableness that may have arisen through friction in the performance of stern duty.

On February 3 last, the tenth annual dinner of the Erie Railroad Association was held at Sherry's in New York, and such a joyous renewal of old acquaintances took place as it has been our fortune seldom to witness. About 200 members and their friends sat down to dinner and for many of them it was the great event of the year, to be looked back to with gratification mixed with longing for the next one. Pres. George Van Keuren occupied the chair and very cleverly acted as toastmaster. At one side he had Admiral W. S. Schley, who delivered a soul stirring address, and at the other, Col. George W. Boyd, general passenger agent of the Pennsylvania, who made a most amusing speech in which his rival general passenger agents were good naturedly told of their strength and of their weaknesses. Mr. D. W. Cooke showed himself equal to the occasion and much badinage ensued, the general freight agents present showing themselves masters of raillery. Mr. J. C. Stuart, general manager, caused great amusement by telling a funny story and making the butt of the joke a general freight agent.

The writer, editor and publisher of Railway and Locomotive Engineering, was an honored guest at the dinner, and he appreciated the privilege more than anything of the kind that ever came to him before. In addressing the meeting he claimed to be an Erie man, for he had earned the first wages he received on this continent by operating a shovel on what is now part of the Erie Railroad system, a statement that was greeted with warm applause followed by the invitation to enroll his name as a member of the Erie Railroad Association, an invitation readily accepted.

Japan Orders Locomotives.

The Japanese Government has just placed with American locomotive builders the biggest foreign order in the history of the locomotive trade. It calls for 102 locomotives, and of these the Baldwin works will build seventy-seven and the Atlantic Equipment Company twenty-five. An order for fifty locomotives went to a Glasgow, Scotland, manufacturer.

The engines to be built here are to be of a composite type which will provide for a fair speed, as well as great power, which will equip them for use either in Corea or Manchuria in connection with troop and supply transportation or for general use in Japan. The Japanese house of Mitsui & Co., acting as purchasing agents in connection with Frasar & Co., of Japan, agents for the Yokohama Bank, placed the order for the Japanese Government.

The orders were placed with American bidders after competition with European manufacturers, and early delivery and transportation facilities were considered in awarding them to American builders. They will be forwarded as rapidly as completed. A further order for eighteen engines is expected to follow the present orders.

One of the features of the advent of electrically driven machinery has been the development of the electric fan. Originally the pulley-driven fan appeared to fulfil the requirements of the purchaser; soon, however, the steam fan with direct connected engine displayed its utility, but to-day the fan driven by an attached motor has shown its general superiority and is rapidly supplanting the steam fan. Progress along this line has been largely due to the energy and foresight of the B. F. Sturtevant Co., of Boston, who have been known for years as the largest manufacturers of fan blowers in the world. For years past, they have been gradually but surely perfecting designs and keeping abreast of the times in this important branch of engineering.

The engines of the first steamer that ever crossed the Atlantic have been recovered off the coast of Cork, after more than fifty years' immersion.

Prairie Type Locomotive for the "Q."

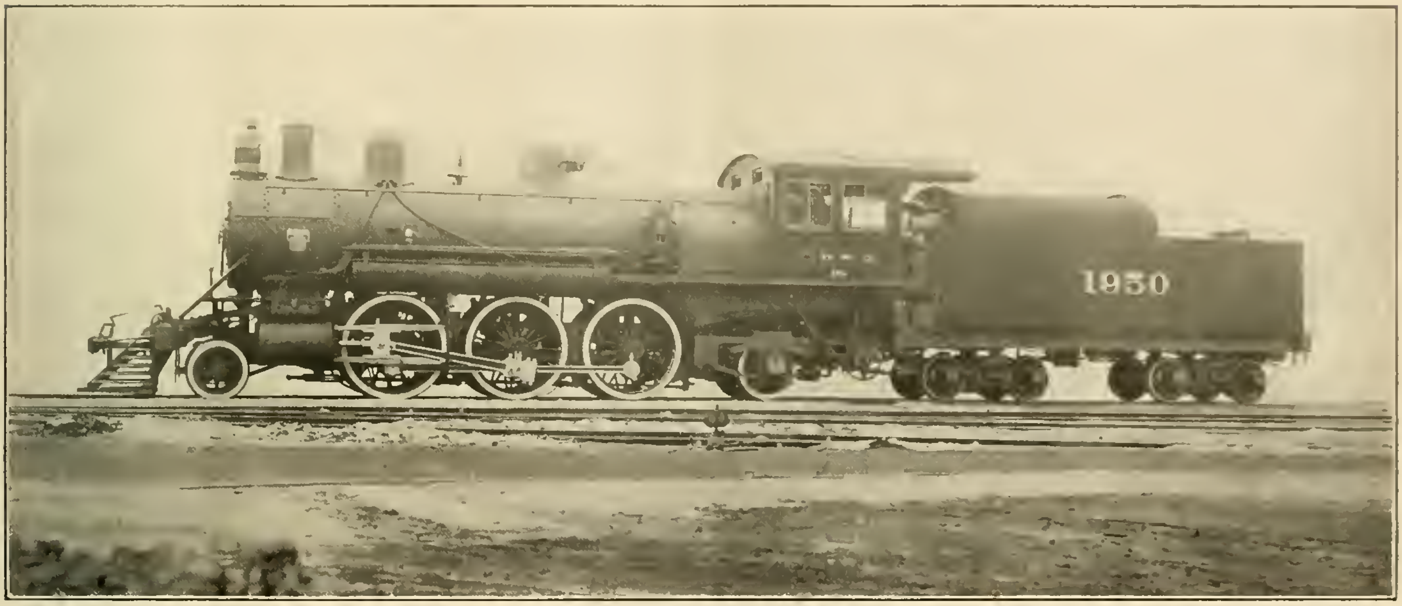
Not long ago the Chicago, Burlington & Quincy purchased some 2-6-2 engines from the American Locomotive Company which were built at the Brooks shops of the latter company. Some of the engines were arranged to burn lignite and others to burn ordinary bituminous coal.

The engines are simple with 22x28 in. cylinders and the drivers measure 69 ins. outside diameter. The calculated tractive effort of these machines when starting on the level is about 53,000 lbs. The valves are of the piston type and are placed close to the cylinders and just above the frame seat. The main drivers are, of course, the center pair and the main driving axle carries the eccentrics. The transmission bar is a steel casting which passes over the leading driving axle in the form of a bow. The forward end is fastened to an upright rocker about 3 or 4 ins. below its upper end. The pivot point of this rocker is about on a level with the pedestal binders. The valve rod connects with the top of the rocker and with transmission bar pinned to the same rocker a little further down, the rocker is in reality a lever of the third class.

One of the properties of a lever of this kind is that in the case before us the valve will have a little greater travel than the throw of the eccentrics. On these engines the throw of the eccentrics is 5¾ ins. and the valve travel is 6⅛ ins. The size of the piston valves is 12 ins. diameter, and the radius of the shifting link is 58 ins. The valve motion is of course direct motion.

The boilers of these engines are ample as steam producers. They are straight top, radial stayed and the first course is 70 ins. in diameter. The fire box measures 109 ins. by 73 ins. with grate area of 54 sq. ft. The heating surface obtained from the box is 171 sq. ft., but the great bulk of the heating surface is got from the 301 tubes, each 2¼ ins. diameter and all 19 ft. long. The tube heating surface comes to 3,343 sq. ft. which, when added to that of the fire box, makes a total of 3,514 sq. ft. This amount of heating surface if in the form of an oblong figure may be better grasped if we remember that an ordinary street or country road is 66 ft. wide, and if we lay off about 53¼ ft. of such a road we would get very closely the area exposed to heat in these boilers.

The working pressure carried is 210 lbs., and though the crown sheet slopes slightly up toward the front there is plenty of steam space above it.



F. H. Clark, Superintendent Motive Power. PRAIRIE ENGINE FOR THE BURLINGTON. American Locomotive Company, Builders

The tender frame is made of 12-in. channels and the tank, with its water bottom, has a capacity of 8,000 U. S. gallons. Fifteen tons of coal can be carried as the fuel supply. The weight of the engine and tender in working order is about 366,500 lbs. A few of the principal dimensions are appended for reference:

Wheel Base—Driving, 13 ft. 4½ ins.; total, 30 ft. 8½ ins.; total, engine and tender, 62 ft. 2¾ ins.

Weight, in working order, 212,500 lbs.; on drivers, 154,000 lbs.

All driving journals, 9½ x 12 ins.; all engine truck journals, diameter, 6 ins.; length, 10 ins.; all trailing truck journals, diameter, 8 ins.; length, 12 ins.; all tender truck journals, diameter, 5½ ins.; length, 10 ins.

Fire Box—Thickness of crown, ⅜ in.; tube, ½ in.; sides, ⅝ in; back, ⅜ in.; water space, front, 4½ ins.; sides, 4 ins.; back, 4 ins.

Piston Rod—Diameter, 4 ins.; piston packing, Dunbar.

Things Are Not Always What They Seem.

There were two occupants of the luxurious first-class compartment in one of a leading Scotch railway's trains. Just as the train was about to start a guard walking down the platform looked in and seeing a well-dressed man and an old woman with a Paisley shawl over her head, he made an attempt to find out if she was in the right compartment.

"Are you first-class?" he said, addressing the woman. "I am that," she replied briskly, "and thank ye kindly for speering; How's yerself?" "Oh, I am all right," said the man as he closed the door.

After the train had left the station the woman said to her companion, "What a nice gentlemanly man that guard was, asking after my health and comfort the way he did, so different from the fellow who sold tickets. He said, 'Where are you going?' and I told him Dundee, as it was none of his business. In truth, I'm going to Aberdeen, but I would not tell it to him, he was so impudent."

When Angus Sinclair first published the articles on smokeless firing of locomotives, that now form the book on that subject, a fierce protest was raised in many quarters to the effect that smokeless firing was impractible, and some animosity was aroused against this paper for advocating such ideas. Time appears to have effected a change of sentiment on the subject, for we find that there is a steady demand among both firemen and engineers for the book on Firing Locomotives.

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Schemes to Increase the Carrying Capacity of Railroads.

There was at one period of railroad history a violent and protracted conflict waged known as the battle of the gauges. What is now practically the universal rail gauge of 4 ft. 8½ ins. was established by the early railway builders as closely approximating the wheel gauge of road carriages and was as good as any other dimension when all forms and dimensions were still under experiment to determine the fittest.

The United States inherited the width of track gauge from Great Britain through locomotives that had been imported, and were provided with wheels suitable for the Liverpool & Manchester Railway. There had been some evolution of the track gauge before that railway was built. The road wagons had wheels about 5 ft. apart. The early tramway wagon wheels were made to the same gauge, and they ran upon track with a ledge inside to keep the wheels from jumping off. Experience taught George Stephenson that it would be better to transfer the ledge or flange to the wheel, which narrowed the gauge to 4 ft. 8 ins. The engineers of the Liverpool & Manchester widened the gauge half an inch for wheel play, and so the standard width was established by a series of accidents.

There were eminent railway engineers, however, who did not acquiesce in this accidental way of settling the rail gauge destined to carry the world's commerce. Isambard Kingdom Brunel, the famous English engineer, when appointed chief engineer of the Great Western Railway of England, in 1833, proceeded to calculate on scientific lines what width of rail gauge was likely to carry loads most economically when traffic on railways became very heavy, and he decided to adopt a gauge of 7 ft., which was done. For a time Great Britain had two leading gauges, 4 ft. 8½ ins., and 7 ft., with strong advocates on each side. For several years a spirited controversy raged between the friends of the two gauges which was carried on so vigorously as to become known as the "battle of the gauges." The friends of the narrower gauge finally triumphed, principally because such lines could be built and operated at less expense than the other, so long as the traffic was so light that locomotives of satisfactory power could be made under the restriction of the narrow gauge.

While the Battle of the Gauges was going on in Great Britain, the Erie Railway was commenced in the United States and the managers, who were well informed business men, with the best engineering ability as counsellors, decided to compromise on the gauge question and they adopted the width of 6 ft. The majority of American railroads were, however, built with a gauge of 4 ft. 8½ ins., and after a time it came to pass that the influence of the greater embarrassed the smaller mileage to such an extent that the managers of the few broad gauge railroads in operation had to change to the standard gauge in order to obtain a fair share of interchange business. The dimensions of rolling stock were then away behind the capacity of the narrow gauge track and it was not foreseen that in a very few years the narrow standard gauge would restrict the capacity of locomotives sufficiently to put a barrier in the way of progress. That time has now come and the more enterprising among railroad presidents are beginning to ask the question, What are we going to do about it?

A few months ago a well-known railroad official was consulted by a syndicate of British capitalists concerning the cheapest means that could be devised to transport the product of coal mines from a rich coal bearing region in Kentucky to tide water. He called the most accomplished experts in the country to his aid and reported in favor of building a railroad of 6 ft. gauge to be equipped with 150-lb. rails, 200-ton locomotives and 100-ton cars. This is no visionary scheme, but is an enterprise supported by unlimited capital and is likely to be carried out within the next few years. When Mr. James J. Hill talked of building an exclusively freight carrying railroad from the lakes to the ocean that would dry up the Erie canal, it is said that a wide gauge capable of accommodating huge locomotives and cars was part of his scheme.

Meanwhile we find that other railway magnates are writhed by the obstacles that prevent them from increasing train loads, and several courses of relief are vaguely under consideration. Electricity is the favorite panacea for the limitations of the steam locomotive running upon a gauge of 4 ft. 8½ ins. With the successful transmission of electricity for long distances with little loss, the prospects of operating heavy trains by that means of transmitting power seem to have advanced. A well-known railway manager who is no visionary remarked to the writer: "The freight locomotive will not be displaced for many years, but a growing part of railway trains will be operated by electricity generated at the coal mines. That will give us the training and experience necessary to gradually transmit electric power for the operating of all our trains. Then we will be independent of the curtailment of the standard gauge, for all the power necessary can be applied to an electric locomotive running on that gauge."

In the course of a newspaper interview Senator Chauncey M. Depew is reported lately to have said: "In ten years' time to come the steam locomotive will find its sole usefulness in filling a place in the museums." The Senator is inclined to be optimistic in nearly everything and his progressive tendencies have carried him away ahead of other prophets, but he voices a sentiment that is becoming strong. He was probably justified in saying that the electrification of the New York Central lines entering New York City will be completed in three years and that no steam locomotive of the present type will then approach within forty miles of New York City.

The men who now run steam locomotives will have the first bid for running electric motors hauling express passenger trains, but they must learn something about electricity to make themselves competent. Ambitious men ought to stir themselves, for the day will soon be here when only those who are ready will be chosen.

A Word to the Anti-Collision Inventor.

We have before us a number of newspaper clippings from various parts of the country, detailing the merits of inventions for the elimination of collisions from railroad operation, and all these inventions aim either at preventing an engineer from running past a danger signal, or they are intended to furnish him with some unequivocal evidence of impending mishap when he comes within the danger zone.

We have before now pointed out in these columns the futility of inventors striving to create collapsible structures or sliding compartments in car construction or deflecting ends for railway vehicles. We believe that a stoutly built steel car will not be telescoped by any ordinary kind of a collision with which we are familiar, but there is no doubt that the shock of a collision which is not taken up by the destruction of some one or more of the vehicles in the train would probably result in the severe injury of the passengers.

We remember reading the account of some patent brake of which the inventor enthusiastically claimed that its application would stop a train running at 40 miles per hour, within a few feet. In such a case the passengers would all have the velocity of 40 miles per hour as well as the car they were riding in, and to suddenly stop this car would be almost equivalent to a personal collision of each passenger with parts of the car; in fact, the partitions and seats and car end would appear to rush at them with a velocity only slightly less than 40 miles per hour, as they were hurled from one end to the other.

The way to prevent collisions is not to have any, and the principal method of bringing this desirable state of affairs about is to so maintain railroad discipline that an engineer entering the danger zone will stop. Discipline need not be tyrannous or harsh, but it must be inflexible and it must have for its end and object the relentless extermination of the Chancetaker—that anarchist of the road! Good discipline on American railroads is improving, we believe, and the enforcement of discipline on steam roads may be assisted in the future by the use of automatic stop signals suitable for out-of-door service in all weathers and just as reliable as the stop signals now in use on the Boston Elevated Railroad and the express tracks of the New York Subway. The number of inventions more or less impracticable which have lately been patented with the object of eliminating collisions may not show much familiarity with operating details of railways or with the manufacture and maintenance of mechanical devices, but what it does show is that the subject is a very live one with the public.

To those in the ranks of the irrepressible inventor who are determined to get into the patent office at all hazards, we have but one word to say: Do not waste time and money on collapsible car construction or deflecting partitions or throttle-closing apparatus, or many colored lights in the cab, or electric bells or third rails and telegraph keys. All that is wanted of a stop signal is that it be simple, workable in winter as well as in summer, and that it shall effectively apply the air brake in the emergency. Nobody will then be injured and the "Please explain" letter from the superintendent's office will follow the delinquent with deadly effect, later on.

Effects of Stress Upon Metals.

When reading a paper on the Recent Researches on the Effects of Stress Upon Metals, before the Canadian Railway Club, Dr. E. G. Crocker, professor of civil engineering in McGill University, Montreal, spoke somewhat as follows: The behavior of metals under stress has been studied so exhaustively, both from the mechanical and experimental sides, that it might appear at the present time that there was little new to be learned, yet a brief account of some recent investigations on the subject may be of interest.

When a bar of iron or steel is subjected to tensional stress and the alteration of length is carefully measured, it is well known that the change of dimensions or strain is proportional to the load applied for a considerable range of stress. When iron or steel are subjected to stresses up to what is known as the yield point, a relatively enormous stretch takes place and the bar becomes altered in character. It will not come back to its original length when the load is removed as it did with loads below the yield point.

Experiments made with iron and steel bars show that overstrained specimens slowly recover themselves, the fuller the recovery the longer the time of rest allowed. When perfect recovery has taken place the bar is found to be perfectly elastic and that now it has a higher yield point than before.

Another most interesting experiment was made. A bar was, immediately after over-strain, buried in snow to a depth of a few inches and was not examined for about six weeks and it was found that its condition remained practically unaltered. That means that low temperatures retard or arrest the process of regaining normal elasticity.

The recovery of overstrained iron or steel is greatly hastened by moderate heat, such as that of boiling water. An example given by Muir is quoted which tells the tale of an overstrained specimen when heated for four minutes to 212° F. and then re-tested, showed that practically perfect recovery had taken place accompanied by a greatly raised yield point.

The microscopic study of overstrained metal is very interesting, and for this purpose a finely polished surface of metal is placed upon the stage of the microscope. When the specimen is stretched and etched by a suitable reagent, no change is observed until the plastic yielding point is reached. Then fine black lines apear on the surface of the grains, forming parallel systems on each grain, but having different directions on different grains. As the stress increases new lines appear. These lines are not cracks, but new faces developed by the slipping or gliding of one part of the metallic crystal over the other. These lines are called slip bands.

The permanent deformation of a metal appears to be due to a succession of these slips taking place, whereby one grain slides over part of the same grain, and the summation of these slips produces a permanent strain.

Messrs. Ewing and Humphrey recently studied by the aid of the microscope iron when subjected to stresses the same as would occur in a railway axle. They found that Swedish iron, with yield point of 14 tons per square inch and a breaking strength of 23.6 tons per square inch, showed no observable change of structure after 1,000,000 reversals of a stress of 5.3 tons per square inch. With further 3,000,000 reversals of a stress of 6.9 tons per square inch, only one slip band made its appearance. With higher stresses more slip bands appeared, their number depending on the magnitude of the stress and the number of reversals. As reversals of stress increase in number, the slip bands grow wider and at the same time grow more indistinct. These may ultimately develop into cracks, even though there was no original flaw in the metal. When once a crack is formed it grows quickly because of the concentration of the stresses at its ends.

Influence of Railways.

There is a general belief that ignorance and superstition cannot long endure the presence of railways, telegraphs and other manifestations of civilization, but some races appear to stand out very firmly against the influence of these modern innovations. During the long period that India has enjoyed the services of railways their presence seems to have exerted very small influence upon the mental advancement of the masses, but in Japan, on the other hand, the railways have stirred the dry bones of ignorance in a remarkable degree. It is a subject of curious speculation concerning how far fossil China will feel the vitalizing force of the railways that are slowly forcing their steel bands into the most conservative of all countries.

The Chinese enjoyed a high civilization of a peculiar sort when the countries that have developed the printing press, the steam engine, the galvanic battery and other inventions were the habitants of rude savages who lived on the spoils of the chase and worked out the physical salvation of their race by constant fighting. But the Chinese advanced to a certain point of development and stopped. In their astronomical conceptions the Chinese stand yet behind the age of Copernicus, believing that the sun revolves around the earth, of whose form and the way in which it is supported in space they entertain the strangest ideas. Of course, in such a country, astrology, soothsaying and all the rankest superstitions still flourish, and a check can only be expected from the gradual influence of the many intelligent young men who have studied in European universities.

In the ordinary application of practical mechanics, curious things are related of the pig-tailed nation, showing that Chinese education is based on ancient traditions, adhered to with great pertinacity. They display a knowledge of the principles of the lever and the pulley, but in the use of these appliances, known in early antiquity, they remain at the point that Europe passed thousands of years ago. In lifting heavy blocks of marble by means of a scaffold, they tie a rope around a stone, carry it over a beam, and with a bight around another beam below, while a lever is suspended from a higher beam, its short arm connected by a rope, with a rope holding the stone. After one set of men have drawn down the lever, those holding the main rope pull it tight and a workman above slips down the knot of the lever rope for another hoist. Many other mechanical operations are carried out in a similar primitive fashion. They would lift a locomotive as they lift a heavy stone if their imitative tendencies did not move them to do as the foreign devils do.

Immense Turbine Driven Steamers.

A long cherished dream of the British transatlantic steamship companies has been to build steamers that would make a speed of thirty knots—over 34½ miles an hour—and make the trip from Liverpool to New York in four days. For ten years designers and engineers have been vainly working on this problem, their main difficulty being the finding of sufficient room for the huge engines necessary to drive great ships at such a speed. The experience of the last five years with turbine engines has convinced those interested that the turbine can be employed to drive transatlantic liners at the required speed, and the Cunard Line managers have placed orders for the building of two palatial ships to be driven by turbine engines at a speed of 25 knots (28.8 miles) an hour, and we may expect within the next two years to see these ocean grayhounds crossing the Atlantic. If these vessels prove successful, there is no doubt that the 30-knot boats will be forthcoming soon.

The power employed in driving these vessels will be enormous, something that even those familiar with immense units of power transmission can scarcely grasp. In these vessels there will be four propellers each driven by a turbine calculated to develop 16,000 horse power, an aggregate of 64,000 horse power. The marine reciprocating engine had been under development for over forty years before reaching the limit of its capacity, and here is a new type of engine that shoots away ahead with little more than one-tenth of the time for development that the older form enjoyed.

There have been a considerable number of turbine driven vessels launched within the last five years, most of them trading in European waters. The largest of these develops 12,000 horse power applied to three propellers. The experience with this one and others indicates that turbines can develop a unit of power on less steam than the best quadruple expansion reciprocating engines.

The enterprise of the Cunard Company in building these ships his been indorsed by the British Admiralty, the most conservative body known to history. The likelihood is that this indorsement was given only after exceedingly careful investigation of the performance of the turbine driven vessels in use.

Washington Railway Appliance Exhibition.

Permission has been granted by the War Department of Washington for the American Railway Appliance Exhibition to temporarily occupy the northern portion of the Washington Monument grounds in connection with the coming International Railway Congress, to be held in this city from May 3 to 14 next, to erect temporary buildings, stands and platforms and to install divers mechanical devices, material and supplies entering into the construction and operation of railways; to inclose the grounds by a wire fence; to convey wires for power, telephone and telegraph and pipes for steam, gas and water; to lay sample sections of tracks and to install track signal apparatus and other moving mechanical exhibits; to appoint special watchmen or guards within the grounds; to establish public comfort stations, with connections with city sewer.

It is agreed that no serious or permanent injury shall be inflicted on the ground, and that all stands shall be removed and the ground restored to its original condition to the satisfaction of the officer in charge. If required, the committee says it will furnish a cash forfeit to guarantee the fulfilment of all conditions.

The Tyrant in Railroad Life.

Two trainmen were visiting in a terminal one morning and one remarked to the other, "It's a sad man the super is to-day, for two men have just been brought in that he cannot scarify with his vile tongue or discharge." The poor fellows had ended their life's work in a head collision in Rockway cutting

The superintendent that the remarks were made about was one of the old-fashioned railroad men who had forced his way up from the tamping by sheer force of efficiency in every position he filled, and this in spite of a savage temper and foul tongue. There were days when he raged over the division like a very wolf in the fold, and with as little resistance. A trifling mistake brought upon the unfortunate a storm of abuse, and many good men who had given years of faithful service to the company were discharged for no other apparent reason than to show that the savage in office had the power to chase out of the service better men than himself.

That species of superintendent is not so much in evidence nowadays as he once was, but there are more of his stripe in the position to injure their fellowmen than there ought to be. A vigorous, pushing official, familiar with every detail of railroad service, is capable of moving business, but when these characteristics are joined to a brutal disposition, the owner is likely to do more harm by demoralizing the men than he can do good by making them step lively.

A Medal for Railroad Heroes.

A curious effort to increase the safety of railway travel is displayed in a bill introduced in Congress by Senator Lodge, "to promote the security of travel upon railroads and to encourage the saving of life." The means he would employ to bring about this very desirable consummation is for the President of the United States to give bronze medals to persons who by extreme daring endanger their own lives in saving or endeavoring to save the lives of others. We suppose that every flagman who went back the proper distance on a night of zero weather and remained there till recalled would be certain to secure a medal.

Anything calculated to rouse public sentiment to a proper value of human life ought to be encouraged, for we do not believe there is a civilized country on the face of the globe where human life is held so cheap as it is in the United States, but we do not think that the move made by Senator Lodge will do any good. Railway men are as heroic as any class of our citizens, and they do not need the encouragement of a bronze medal to stimulate them on the path of duty even when it leads to great danger.

Protecting the Express Companies.

With all the agitation against railroad freight rates and against the exactions of private car lines going on at present, it is curious how nothing has been said against the infliction imposed upon the public by express companies. Yet the tyranny of express companies comes directly home to the people, and there are few households that do not have reason to complain about the overcharges of express companies.

We note one exception to the general silence concerning the injustice of express companies. C. N. Post, of Battle Creek, Mich., proprietor of various breakfast foods and a most energetic and enterprising man, is after the express companies, and particularly their legislative protectors. One day last month Mr. Post presented to President pro tem Frye a petition addressed to the Senate in the form of an affidavit charging Senator Thomas C. Platt, of New York, as president of the United States Express Company, with violating the Sherman Anti-Trust law, asking an opportunity to present proofs, to the end that Mr. Platt might be expelled from the Senate.

The petition was backed by an affidavit by Clarence G. Dawson and Edward M. Dawson, Jr., setting forth that Senator Platt informed them that he was against the bill "because it conflicts with my express money order business."

Senator Platt seems to represent senatorial sentiment fairly well.

A Plucky Car Man.

One of the new acetylene lighted cars on the Burlington road was badly damaged by an odd accident one day last month and the man who was charging the tank displayed heroic characteristics.

It sometimes becomes necessary to replenish the reservoirs of the lamps with a new cartridge of gas after the train has been some hours out. A car-man attempted to do this, but the cartridge, which weighs about 100 lbs., leaked, and when he reached the lighted coach an explosion followed. The glass of the partition was forced out and the car man was knocked down, but he retained his presence of mind and hurriedly put the leaky tank out of doors before further damage was possible. The car man had his hair and eyebrows singed and he received some painful burns, but none of them serious.

DOUBLE ENDER TANK LOCOMOTIVE FOR CHICAGO & WESTERN INDIANA.
Peter H. Peck, Master Mechanic. Rogers Locomotive Works, Builders.

Double Ender Tank Locomotive.

Our illustration represents a 2-6-2 double end tank locomotive built by the Rogers Locomotive Works, of Paterson, N. J., for the Chicago & Western Indiana.

The engine is simple, with ordinary balanced slide valves driven by indirect motion in the usual way. The cylinders are 18x26 ins. and the driving wheels, six in number, are 63 ins. in diameter. Taking the mean effective pressure in the cylinders to be eighty-five per cent. of the boiler pressure we find that the calculated tractive effort of this engine is about 22,700 lbs.

The pony truck in front and the first pair of drivers are equalized together, and the main drivers, the rear drivers and the carrying wheels under the cab are equalized together. All wheels are flanged. The driving wheel base is 14 ft., while that of the whole engine is 31 ft. 2 ins. The engine truck carries 20,000 lbs., the rear truck under the cab sustains 40,000 lbs. weight and the drivers carry 130,000, making a total weight of 190,000 lbs. for the whole machine.

The boiler is one of the straight top radial stayed variety. The fire box is spoken of as a wide one, and it is wide in the sense that it comes out over the top of the frames, being, in fact, 66 ins. wide and 102 ins. long. This gives a grate area of about 46¾ sq. ft. The tubes are 249 in number and are 13 ft long. This gives a tube heating surface of 1,694.9 sq. ft., and when the 146½ sq. ft. of fire box heating surface is added to this the total heating surface amounts to 1,841.4 sq. ft. The boiler itself is 60 ins. diameter at the smoke box and carries a working pressure of 200 lbs.

The tank is of course in three sections, one on each running board and one at the back of and below the cab. The running board tanks slope toward the front, so as to give an unobstructed view of the track to the occupants of the cab. The part of the tank below the cab is lowest and both the running board tanks communicate with it, and from it the feed water for the injectors is drawn. The combined capacity of the tanks is 3,500 U. S. gallons, and about 5 tons of coal can be carried. In the tank below the cab, which some people might call a water bottom, there are two pocket steps just above the regular hanging steps for the cab door. These pocket steps, if one may so call them, are something like the niches for hands and feet which an Alpine climber would cut out of an ice wall when on a long, hard climb. A few of the principal dimensions are as follows:

Cylinders—18 x 26 ins.
Driving Wheels—Diameter, 63 ins. Axles—Material, steel. Journals, 9 x 12 ins.
Boiler—Type, straight top, radial stayed; material, flange steel; thickness of barrel, 21-32 in.; thickness of dome course, 21-32 in.
Fire Box—Crown, 13-32 ins.; thickness, fluesheet, ½ in.; back, ⅜ in.; sides, 11-32 in.
Engine Truck—Style, Radial swing bolster.
Engine Truck Wheels—Diameter, 36 ins.
Trailing Wheels—42 ins. diameter.
Trailing Journals—8 x 13½ ins.
Safety Valves—Two, 2½ ins.
Lubricator—Triple-sight feed.
Headlight—16 ins. diameter.
Boiler Covering—Sectional magnesia

Heating.

The normal internal temperature of the human body is very near 100 degrees, independent of the temperature of the surrounding air. By respiration the continuous process of slow combustion is kept up, the oxygen of the air uniting with the carbon of the blood passing through the lungs, to form carbonic acid. As in any case of combustion, overheating takes place unless provision is made for the distribution of the heat generated, so the body is kept at its normal temperature only by the abstraction of heat from it. The actual heating of the body is not the ultimate object of heating, but in reality provision is made for the abstraction of heat generated by the vital functions, without making too great a demand upon the physical endurance of the individual.

Three means are provided for the healthful dispersion of heat from the human body. First: By radiation into the air and surrounding objects. Second: By conduction, principally to the air immediately in contact with the body. Third: By evaporation of moisture from the lungs, throat and skin. Under the conditions of summer air, the last two are generally about equal, but the greater part of the heat is dissipated by the first means. Air is nearly a perfect non-conductor of heat, but radiation takes place through it readily. We may enter a room having a temperature of 75 degrees, with walls at 50 degrees, and feel chilled, simply because heat is rapidly radiated from the body, through the air to the colder walls. In comparatively dry air equality of temperature is kept up by a steady but imperceptible evaporation from the skin. In moist air this rapid evaporation is prevented and the water is deposited as perspiration, the air being too heavily laden to take it up. On the other hand, when the air is in motion it increases both the evaporation and conduction by the constant bringing of fresh air to take the place of that already moistened or heated. If, under any circumstances, one of these three means fail to abstract heat rapidly enough, the removal by the other means is increased, and equilibrium of temperature kept up.

High humidity has the effect of modifying very materially the temperature at which comfort may be secured. The excessive humidity of the atmosphere in the West and South of England has, owing to the reduced evaporation from the body, the effect of making a temperature of 56 degrees in that country equally as comfortable as 80 degrees in the dryer climate of Canada or Minnesota.

In this country, where some means of heating is usually required during about seven months of the year, the amount of heat necessary and the economy exercised in supplying it are vital questions. As will appear in what follows, convenience and economy can best be secured by an intelligent union of the heating and ventilating systems.

Extract from Treatise on Ventilation and Heating. B F Sturtevant Co., Boston, Mass.

Progress of the Pan-American Railway.

At a meeting of the permanent committee of the Pan-American Railway, held at Washington last month, an interesting report was submitted of the progress made on the far-reaching railway which will ultimately enable travelers to go by rail through the heart of South America.

The statement was made that within three years a railway journey from New York or San Francisco to Guatemala City will be possible. The reports showed that the line from Tehuantepec to the Guatemalan border is being constructed at the rate provided in a concession by the Mexican Government, and that in Central America several enterprises for completing links in the interoceanic lines are being carried forward from the general plan of an intercontinental trunk line north and south.

In South America the Argentine Government is building the extension of its system into Bolivia. The latter country has, by special decree, set aside $10,000,000, which it has on deposit in Europe for railway construction, and New York capitalists probably will build the roads. American engineers are now making surveys under an arrangement with the Bolivian Government.

Bolivia also has entered into a treaty with Chile by which that country advances capital for railway construction. In Chile itself the railway tunnel through the Andes is progressing under the contract awarded to a New York firm, and within a few years Valparaiso and Buenos Aires will be joined.

In Peru the conditions are reported to be unusually favorable. The government has completed its surveys for the main links which it is proposed to build from Lake Titicaca north and from the existing system of railways south. A special railway fund was created by the Peruvian Congress. Several private enterprises also are under way in Peru and a large amount of American capital is invested in them

Southern Pacific Hospital Car.

A press dispatch from the West states that the Southern Pacific has completed plans for a hospital car for use by that line in the State of California. Mr. H. J. Small, general superintendent of motive power of the road, has designed the car, which is being very fully and completely equipped.

The hospital car has been built at the Sacramento shops, and is 67 ft. long What may be called the "ward," has accommodation for 12 people and the berths are so arranged that they can be lowered without disturbing the patients. The car is extremely smooth riding.

There is an operating room with all the necessary apparatus for sterilizing surgical instruments and applying antiseptic washes for wounds, etc. There is also a private state room for the physicians and a room for the attendants. A kitchen has been provided, and all kinds of lockers and cupboards are to be found conveniently placed. The car is considered quite an important addition to the medical equipment of the road.

The Chicago, Milwaukee & St. Paul road have been using an artesian well at Corliss for part of their water supply. This well has lately gone dry and engines have had to go on to Racine, Wis., for water. It is proposed to sink a tank of 100,000 gallons' capacity in the earth at Corliss and fill it by running a special water train of from twelve to fifteen cars to that point as often as may be necessary.

A noted French balloonist who has been visiting the United States has gone away disgusted because Americans do not take to flying machines. They find jeopardy enough on trains called flyers to restrain them from locomotion that might entail the fall of a mile or two before reaching terra firma

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. When a student wishes to receive a private answer, he is reminded that it is usual to send a stamped envelope for the return letter. We will be glad to answer any question relating to railway matters, but prefer that they be suitable for our question and answer department. All letters intended for Our Correspondence School ought to be addressed to Department E.

Explanations.

Owing to circumstances over which he had no control, the chief had to be absent from the office when they were getting the February number ready, and several mistakes were made of the kind likely to happen when the paper is edited a thousand miles away from the publishing office. In the first place the third series of questions and answers was cut off before it was finished. We will now resume the course where it was broken off accidentally.

In the answer to question 12 of the first series, there is a typographical error. We wrote that the temperature of water at 200 pounds gauge pressure was 388 degrees Fah. (the actual figures are 387.85), and the printers made it read 338°. This has brought us seventeen letters up to date from correspondents making the correction, which we accept as flattering testimony of the attention bestowed by our readers upon these lessons.

Many of the letters complain that we do not tell how we figure out the temperature at the high pressure quoted. We took the figures from Kent's tables on the properties of saturated steam. This was done because it was not the intention to ask the student to figure out the temperature any more than he would be asked to demonstrate why squaring the diameter and multiplying by .7854 gives the area of a circle.

But as some of our readers seem desirous of having a rule for finding the temperature from the pressure of steam, we will gladly give the required data. There are several formulas for finding the temperature of steam all based on the experiments carried out by the famous scientist, Regnault. Here is what we consider the easiest:

$$t = \frac{2938.16}{6.1993544 - \log p} - 371.85$$

in which t is the temperature and p the pressure in pounds per square inch. In figuring out the formula, the logarithm of 214.7, the steam pressure is found first, as the gauge pressure of 200 pounds means 214.7 pounds absolute pressure. The logarithm of that number is 2.331832, which is subtracted from 6.1993544, the remainder being used as the divisor for 2938.16. The product of that operation is 759.7, from which 371.85 is subtracted, giving 387.85, the exact temperature of the steam at 200 pounds gauge pressure.

That species of figuring is no milk for babes, but it gives very good practice in the elementary rules for those who are ambitious enough to take up the work. Those who feel interested in working out the problem will find useful help in Colvin's Machine Shop Arithmetic, page 14. The logarithm figures will be found in the tables published in nearly all engineering hand books. We advise our young students to practice on different steam pressures, using the saturated steam tables as a check.

Third Series.
(Continued.)

91. Should one of the forward tires of a ten-wheel engine break, what must be done to bring the engine in?

A. Run the wheel upon a wedge so as to clear the rail under all conditions; remove the oil cellar and fit a block in its place; then place another block between bottom of box and pedestal binder. Also block under the equalizers nearest the disabled wheel to take the weight off the journal.

92. What is a good method of raising a wheel when jacks are not available?

A. To run them up on frogs or wedges.

93. How can it be known whether the wedges are set up too tight and the driving box sticks and in what manner can they be pulled down?

A. If the wedges are set up too tight, the boxes will heat, the engine will ride hard and have a rough, jerky, up-and-down motion.

Drawing down the wedge bolt snug and running the wheel upon blocks or wedges and off again will generally bring down a wedge as the box drops down. A little oil or kerosene between wedge and pedestal will often be a help.

94. In reporting work on any wheel or truck on engine or tender, how should they be designated?

A. It should be designated as engine truck, driver or tender truck wheel, giving the exact location and side.

Some roads have adopted a method which prevents mistake by numbering the wheels, beginning at the forward engine truck wheel on right side, going around the tender and ending with engine truck wheel on left side, in consecutive numbers, as wheel No. 1, No. 2, No. 3, etc. On an eight-wheel engine the right forward engine truck wheel would be designated No. 1, while the left forward would be No. 16, according to this system.

95. What are some of the various causes for pounds?

A. Wedges not properly adjusted, loose pedestal braces, lost motion between guides and crossheads, badly fitting driving brasses, improper keying of rod brasses, engine and rods out of tram, loose piston on rod or loose follower bolts.

96. How can a pound in driving box wedges or rod brasses be located?

A. By placing the right main pin on the upper forward eighth, which brings the left main pin to the upper back eighth Then by blocking the drivers, giving the cylinders a little steam and reversing the engine under pressure, both sides can be tested at the same time.

97. When should crossheads or guides be reported to be lined?

A. When there is sufficient lost motion between crosshead and guides to cause a jumping motion when the pin is leaving either dead center and the crosshead is beginning the return stroke.

98. When should driving box wedges be reported to be lined?

A. When the wedge has been forced up as high as it can go and lost motion appears between wedge and box. It should then be reported lined down. Lining up is sometimes reported by enginemen, but this is incorrect.

99. When should rod brasses be reported to be filed?

A. When there is sufficient lost motion to cause pounding.

100. When should rod brasses be reported to be lined?

A. When the key is down to a point where it cannot be forced down further to prevent brass working in strap.

101. When should lost motion between engine and tender be taken up?

A. When there is ¼ in. or more lost motion between engine and tender, causing an undue strain on the drawbar by the forward and backward lurching of the engine while in motion, or the forward lurch in starting. It also causes severe strain on draft rods.

102. Describe the principle on which an injector works.

A. The principle on which an injector works is a combination of forces, velocity and an induced current of water passing through suitably proportioned tubes, designated as steam nozzle, combining tube and delivery nozzle. Under a given pressure the velocity of escaping steam is much greater than that of water, which would be ejected were a hole opened in the boiler below the water line. The reduced orifice in the steam nozzle naturally increases the velocity of the escaping steam as it enters the combining tube where it entrains the feed water and condenses. As the escaping steam is being condensed it has lost none of its velocity except that due to friction of the pipes through which it passes, consequently it has a vastly greater penetrating force after condensation than the resisting force in the boiler. Leaving the combining tube the condensed steam and feed water now pass through the delivery nozzle into the branch pipe, where the ram-like force imparted to the water by the velocity of the escaping steam unseats the boiler check and permits the free flow of water to the boiler.

103. What is generally the cause of failure of the second injector, and what should be done to obviate this failure?

A. Infrequent use causes the various parts to corrode and the check to lime over and stick. Frequent use and a trial before starting on trip will guard against such failures.

104. What are the advantages of the combination boiler check?

A. It reduces the number of boiler check and injector failures.

105. If an injector stops working while on the road, what should be done?

A. First ascertain the cause before applying the remedy. It may be due to a disconnected and closed tank valve, clogged strainers, loose coupling in feed pipe which destroys the vacuum necessary to raise the water when starting a lifting injector, stuck check, etc.

106. How can a disconnected tank valve be opened without stopping?

A. By closing the heater valve and forcing the steam from injector back into tank to dislodge valve.

107. If the steam heat gauge showed the required pressure and cars were not being heated properly, how should one proceed to locate the trouble?

A. First make sure that the connections on the cars were all coupled and their respective valves opened to the rear end of train. If no steam appeared at rear car, examine each angle cock or valve, and, if these were open, look for the trouble at the regulator reducing valve.

108. How does the steam heat reducing valve control the pressure?

A. By suitably adjusted springs and valves which restrict the steam passages in proportion to the amount of tension of the springs exerted upon the valves.

109. What constitutes abuse of an engine?

A. Improper care, working at a longer cut-off than necessary, pumping the water irregularly or in greater quantities than required.

110. How are accidents and breakdowns best prevented?

A. By frequent and careful inspection before starting and during each trip.

111. What are the duties to be performed by an engineman when giving up his engine at the terminal?

A. To thoroughly inspect the engine and report all defects in an intelligent manner.

112. In what manner should an engine be inspected after arrival at terminal?

A. All running gear, frames, cylinders, saddles, bolts, wheels, fire box, smoke arch and any other parts of the engine should be thoroughly examined and all defects correctly reported. No superficial examination is sufficient.

113. In reporting work on an engine, is it sufficient to do it in a general way, such as saying, "Injector won't work;" "Lubricator won't work;" "Pump won't work;" "Engine blows," etc.?

A. No; he should be explicit and assign a cause for every failure, so as to assist the shop force in remedying the defect.

GENERAL Questions Answered

(32) Train order question:

Train 117 is a second-class train. Train 118 is a third-class train. Train 117 received a train order at (C). Train order (No. 1). No. 117, Engine 1324, will wait at (D) until eighteen twenty-five (18.25), and (E) until eighteen forty-five (18.45) for first 118, Engine 1325, at (D). No. 117 receives train order (No. 2) that part of order (No. 1) reading No. 117, Engine 1324, will wait at D until eighteen twenty-five (18.25) for first (No. 118) Engine 1325 is annulled. (E) is a telegraph office. Has the dispatcher the right to give order (No. 2) to No. 117, Engine 1324, at (D) before he gets the signature of the conductor of first 118, Engine 1325, according to the Canadian Pacific rules? A.—According to the Standard Code rules of the American Railway Association the dispatcher would have the right to annul that part of order No. 1 providing for No. 117 to wait at D for first No. 118, but would first have to send order No. 2 to first No. 118 at E or some place beyond and secure the proper response from the operator, to make sure that first No. 118 would receive the same before leaving E. This would be perfectly safe, for the reason that the order would still hold No. 117 at E until 18.45, but were it not for this fact, the dispatcher would, according to the principles of train dispatching, be compelled to secure the signature of the conductor of first No. 118 or in some other way make sure that they had arrived at the point where the order was waiting for them, before completing order No. 2 to No. 117. This would be necessary, because, with the order annulled, No. 117 might reach a point beyond that at which order No. 2 was waiting for first 118 before the arrival of the latter and a collision would result.

INVENTOR OF SAFETY VALVES.

(33) R. M. B., Worcester, Mass., writes:

We have been having a little dispute about who was the inventor of the safety valve. A says it was invented by James Watt and B says it was invented by a man named Newcomer, who made steam engines before Watt's time, while C says it was invented by Oliver Evans, who was the first inventor to use steam of high pressure. We have decided to refer the question to you. A.—The safety valve is popularly belived to have been invented by Dr. Papin, a distinguished scientist who experimented a great deal with steam during the 17th century. He was the first to apply a lever on which weights could be hung to regulate the pressure on the safety valve. Crude kinds of safety valves, however, had been used from time immemorial for distilleries, glass furnaces and other places where pressure of vapor had to be controlled. The primitive safety valve was a ground plug weighted by a leaden cap.

DISTANCE OF RESERVOIR FROM PUMP.

(34) J. J. C., Live Oak, Fla., writes:

I have a temporary air plant consisting of an old 8 in. air pump and an old main reservoir off of a locomotive. The steam pipe to pump is 1 in. and the air discharge is ¾ in. Now what I want to know. Does it make any difference how far away from the pump the reservoir is placed, or should I have a large discharge pipe to the air reservoir, if the reservoir is a long way from the pump. I have the pump close to the steam boilers and the reservoir at the shop some three hundred feet away. The pump seems to work hard when we are using the air tools? A.—A long discharge pipe between the pump and main reservoir cools the air and deposits moisture in the main reservoir, but in a cold climate a very long discharge pipe is liable to freeze. In your climate, however, freezing of this nature should not be feared. The remote location of your reservoirs is in your favor. The larger discharge pipe would merely add volume to your main reservoir, and you would not get any other beneficial results thereby. Your pump laboring hard when air tools are bing used is doubtless due to the air pressure required to operate the pneumatic tools. You should either have more pump capacity or very much more main reservoir capacity to operate pneumatic tools successfully. More pump capacity is preferable.

EFFECT OF LOST MOTION IN SLIDE VALVE.

(35) M. R. S., Melrose, Minn., asks: Would a 1/16 in. lost motion in the slide valve 5, in the New York duplex No. 2 air pump, fitting onto the valve rod have a tendency to prevent the pump from working properly, and would it cause the pump to work lame and prevent the same from charging the train line properly, and if it has any effect what would that be? A.—One-sixteenth in. lost motion would hardly affect the pump materially in its operation although the tendency would be in that direction, but it would probably be insufficient to give any considerable trouble; however, this lost motion should be kept down as much as possible in order to get the best performance of the pump.

BROKEN TRAIN PIPE.

(36) A. C. E., Danville, Ill., writes: A certain engineer was running a passenger train, and in some manner his train line pipe broke on engine, just back of the tee below the brake valve. Now the question is, could he come in with his brakes in working order with this pipe broken. One man claims he could by securely plugging the broken part, closing the reducing valve and going in front of the engine and coupling the train line into the signal hose, and doing the same thing back of the tender. This is a difficult coupling, but it can be made by springing jaw on signal hose with cold chisel. You are now taking your air in a roundabout way, using signal line for a brake line. Could this be done? A.—Yes, it might be done in an extreme emergency; but, of course, you would loose your air signal.

TO LEVEL ENGINE CAR SPRINGS.

(37) W. C. F., Brookville, Pa., writes: I am running a Baldwin consolidation engine, 65 tons on drivers, and 5 tons on engine trucks. She is about 1½ ins. low in front. Her two front drivers are equalized with the pony truck. As I have to do my own work, please tell me an easy way to raise her and where to begin? A.—In the first place, see if the front springs are in proper shape to hold the required weight. If the springs are in good order, screw down the nut on the engine truck center pin bolt. If this does not furnish sufficient means for raising the engine, then shorten the link between the cross equalizing bar and the central or truck equalizing beam. It is our opinion that the life is out of the springs under your engine and that they have lost their set. We should recommend the changing of the springs in preference to shortening the link.

FLANGED OR PLAIN DRIVING TIRES.

(38) H. C., St. Paulo, Brazil, writes:

(1) Will you please explain why it was thought advisable to have all the wheels of locomotives flanged, in cases where some were formerly made flangeless? What are the indispensable precautions to avoid excessive friction between flanges and rails? A.—In the report of the committee on flanged tires, printed in the 1899 proceedings of the Master Mechanics' Association, pages 202-208, it will be seen that the advantages claimed by the advocates for all flanged or partly flanged tires are about the same, with the exception that the roads using flanged tires on all driving wheels have certain advantages which may be enumerated thus: As the tires wear down, the flange gives them greater strength, and there is less liability of thin tires slipping on the center. It is only necessary to carry one kind of tire and one kind of brake shoe in stock where all flanged tires are used. Some roads set the flanged tires of the middle wheels in, say, a total of 3/16 of an inch, and lateral motion of about one-eighth of an inch is given to each axle box.

SETTING HAND BRAKES.

(39) O. R. E., Clifton Forge, Va., writes:

In former years, when freight trains were partially equipped with air brakes, the rule followed with hand brakes was that if any were necessary to assist the air brakes, to set the necessary number of hand brakes immediately back of the air braked cars. Since all trains are now practically air braked, and it is found that sometimes hand brakes are necessary, what is the objection to setting them on the head end. This would keep the slack of the train bunched when brakes were released and would assist in handling the train smoothly. A.—Conditions have changed in respect to air braked trains, and while it is not considered the best practice to use hand brakes on air braked cars when they are in operation, still it is sometimes thought advisable, and is actually done. In this case, perhaps, while it is a bad practice, it would be a better plan to set a number of hand brakes on the head end, but not with a lever or club. The temptation for a brakeman to use but one or two brakes, and to brake these two individual cars exceedingly hard, results in slid flat wheels.

(40) J. A. F., Columbus, O., writes: In looking over some of my old books and papers, I find in several places where you speak of inside clearance, also your "Traveling Engineer's Examination Chart," which you issued several years ago, asks in question thirty-four (34). "What is inside clearance?" "What is it for?" I have asked several men who have had years of experience, but their answers are so different that it leaves me where I started on the question. Some say you mean what I would call negative inside lap (or in other words, when the valve is in the center of its travel the cavity is wide enough to allow steam to pass from both steam ports to the exhaust port), which does away with compression so far as the exhaust side of the valve is concerned. Others say you simply mean inside lap. If you will please explain this so I will be able to convince some of these older ones with whom I dislike to dispute, it will be a great favor. A.—On some engines the valve is made so that the inside edges lap a little over the bridge when in the middle position. The purpose of that is to delay the exhaust opening for release and to advance it for compression. Inside lap has generally been given to slow moving engines, inside clearance to those that have to run fast. Cutting away the inside of the valve, on the other hand, so that its edges do not reach the bridges when on the middle position, accelerates release of steam and delays the closure for compression. This is called giving inside clearance. The purpose of giving inside lap is to get more expansion out of the steam by delaying the period of exhaust; the purpose of giving valve clearance is to accelerate release and delay valve closure, thereby helping to reduce back pressure and compression.

Lackawanna Locomotive Wins Medal.

A gold medal has been awarded by the superior jury of awards of the Louisiana Purchase Exposition at St. Louis to the Lackawanna Railroad on the exhibit of consolidation locomotive 306. The locomotive was designed especially for moving heavy tonnage, and is merely one of a number now in service on the road. The total weight on wheels is 191,500 pounds.

Like all Lackawanna locomotives, it burns anthracite coal exclusively, boilers having a working pressure of 200 pounds. There is a total heating surface of 2,786 sq. ft. The total wheel base of both engine and tender is 53 ft. 4½ ins. The tank has a capacity of 6,000 gallons of water.

A third section of the network of the underground railway has just been opened in Paris. All these lines communicate with each other, and passengers can pass direct from one to the other without coming above ground, and without paying an extra fare.

Air Brake Department.

CONDUCTED BY F. M. NELLIS.

"To Improve the Air Brake Service."*

BY DAN DUGAN.

One particular letter in the General Manager's morning mail had caused that official to pause in his speedy and systematic disposal of the same, and his summons, through the medium of the electric "buzzer" and Burns, the chief clerk, had brought Mr. Burke, the Supt. Motive Power, and Jennings, the Air Brake Inspector before him. The S. M. P. uneasily filled one of the luxurious leather chairs, while Jennings, as seemed his usual fate, occupied "the carpet" before the G. M.'s desk, standing facing that official.

"Mr. Burke, your letter here, requesting passes over the D. L. & H. and P. L. L. railroads, for Jennings and his wife to the Twelfth Annual Convention of the Air Brake Association in New Orleans, April 11," began the G. M., extracting from the communication in his hand, "is flagrantly against our rules as you know. While we will issue such transportation over our own line, the pass agreement prohibits requesting it over foreign lines. You ought to know that."

"I know that is the general rule, sir, but Jennings' case is an unusually deserving one, and I thought perhaps you might make it an exceptional one."

"How do you make that out?"

"Jennings has saved us a good deal of money since he came with us, sir, and the Air Brake Association has been his greatest assistant."

"What has the Air Brake Association ever done for the Midland, Jennings, either directly or indirectly?"

"Well, sir," began the inspector as he shifted his weight from one foot to the other, and tried to blink a cinder out of his eye which he had caught while riding the engine of the "Chain Lightning" two hours ago, "what success I've had in establishing good air brake practice on the Midland is due the Association, from attending its conventions and mixing with its members, I could"—

"But tell me," interrupted the G. M., "how much in dollars and cents, has all this brought to the Midland? How many more 100-ton freight engines and 100-ton capacity steel cars have we been able to buy since you began attending the Air Brake Association conventions? And how many more dollars in dividends has the Midland been able to pay its stockholders since you brake fellows began meeting and swapping air brake tales?"

"That's a 'corker'," thought the S. M. P., who, while having great faith in the inspector, feared this question would floor him. But Jennings' self-assurance even increased as he replied: "Thirteen years ago, sir, when the Air Brake Association was organized, freight trains were long if they contained 35 cars, and ten air cars were a lot to couple up and operate. Now, we have 75 and even 100 car trains, all air braked. Freight train speeds then were 20 and 25 miles per hour. Now, they are double that. Then, if a car needed its triple valve cleaned, the car was put out of service for at least one day. Now, the triple valve is changed in a few minutes' time, and the car keeps on earning money undisturbed. Five thousand cars per year, needing triple valve repairs, are not many for this great Midland line, and rating a car's service at five dollars per day, this item alone, devised and introduced by an Association member, and adopted and recommended by the Association, is saving the Midland twenty-five thousand dollars per annum."

"That would nearly buy two good consolidated engines, Jennings, or a train of 100-ton capacity steel cars," rejoined the G. M. "But don't you think you are over-crediting the achievements of the Air Brake Association? Didn't government legislation, which made brake application compulsory, do much to equip freight cars with air brakes? And did not the Interstate Commerce Commission compel roads to use brakes?"

"Yes, sir," replied Jennings, "but the Air Brake Association developed and introduced methods of maintenance which made these requirements possible. Had the Association not started a campaign to reclaim the neglected and debilitated brakes and to maintain them, all the compulsory laws of Congress and the nagging of the Interstate Commerce Commission would have amounted to nothing. It's easy to command a thing done, but often quite difficult to effect its accomplishment."

"Yes," interposed the G. M., good naturedly, "that's true. Joshua of old commanded the sun to stand still, but I guess it's still moving, for our late ecclesiastical colored friend of Virginia, John Jasper, only ceased with death to offer proof that 'de sun do move.' What other dollars have you saved, Jennings? I'm getting interested."

Jennings resumed: "The M. C. B. maintenance rules are so favorable to roads doing air brake work on foreign cars, that an air brake gang in a yard can be made self-sustaining by doing repairs to foreign cars. In this way I have eight gangs of five men each at points over our line which are actually supported by foreign lines. Our brakes are maintained at no cost to ourselves. The foreign lines pay these gangs for work done to their cars and ours, too. These 40 men get $2.00 per day, each, or $80.00 per day, aggregate. In one year these gangs of ours receive $29,200 in wages paid by foreign lines. This favorable schedule of prices to roads inclined to maintain brakes was originally drafted by a member of the Air Brake Association, and afterwards adopted and recommended by that body."

"A clever bit of legislation," remarked the G. M. "That $29,000 would buy two 100-ton 'battleships,' or a whole train of steel cars. A good saving, Jennings, but why don't the foreign lines 'get onto' this wrinkle and repair brakes on foreign cars themselves?"

"Some roads do, but others don't. Their inspectors don't know. They don't attend the conventions. They're not encouraged to do so."

"Well, they ought to be," replied the G. M. "Any more dollars saved, Jennings?"

"Yes, sir; we used to hold an engine in the roundhouse to make air pump repairs. Now, we have all air pumps repaired in the machine shops and stocked; and if an engine comes into the round house with a disordered pump, we exchange a repaired and tested pump from stock for the defective one in less than ten minutes, while the fire is being cleaned. We used to have 60 pump failures a month, the roundhouse work averaging about three-quarters of a day for repairs. At this rate, we lost 45 engine-days per month; and estimating a locomotive's service at $15.00 per day, we lost $675.00 per month from air pump failures, or $8,100.00 per year. There is a positive end to this loss, due to the use of this practice, which was originated and adopted at one of the conventions of the Air Brake Association."

"Enough to buy several more steel cars," interjected the G. M. "That'll do, Jennings, I guess your Association does something besides junketing. It saves dollars. Make your arrangements to go to the New Orleans convention in April. I'll attend to the transportation."

* Motto of The Air Brake Association.

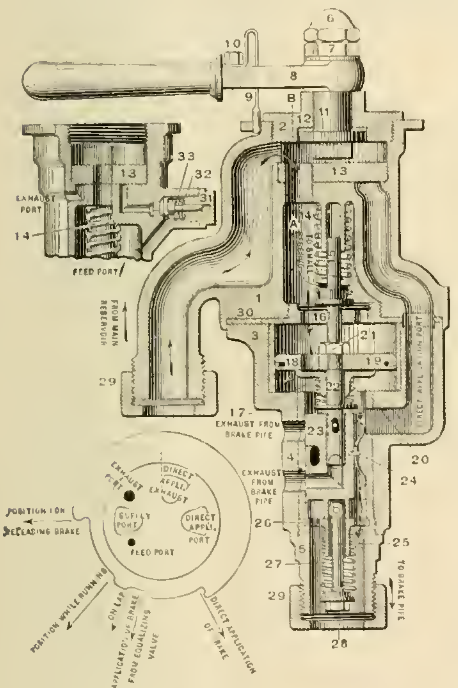
As Jennings disappeared through the green swinging door, the G. M. turned to the S. M. P., and said:

"Your letter is right, Mr. Burke; Jennings is deserving, and the transportation will be forthcoming. See that his salary is paid while away; also his expenses."

As the S. M. P. made his exit through the green swinging door, the G. M. mused: "In pursuing big things, we frequently suffer the escape of little things, which are really big. Who would have thought it? Sixty-two thousand dollars per annum saved by a young fellow with grimy hands and face, riding around on engines, and scouting through yards, roundhouses and machine shops. But it is the man on the firing line who sees and learns how to do things. And dollars count."

First Type of Equalizing Discharge Brake Valve.

Very few of the readers of Railway and Locomotive Engineering will recognize the old drawing of a brake valve which I am sending you for illustration. I believe this is the first type of an equalizing discharge valve. As will be seen, its arrangement is suggested by the slide valve and graduating valve in the triple valve.



AN OLD FORM OF EQUALIZING BRAKE VALVE.

In the release position, air passes from the main reservoir down through the rotary valve 13 to chamber A, thence through a port down on top of piston 19, against a check valve, seating upwards and held in place by a spring. The air forcing this check valve from its seat, permits air to pass down through, round the slide valve to the train pipe

In running position, the air gets through the rotary valve 13, down through the supply ports and through the excess pressure valve, which is controlled by a spring, 32, having a tension of 20 lbs. When this valve is forced from its seat air will pass to chamber A, and from there on as described in the full release position.

In service application, pressure is reduced in chamber A, there being no equalizing reservoir on this valve, and piston 19 rises, carrying with it the slide valve 23, until its graduating port is opposite the exhaust port. The piston 19 responds to reduction in chamber A, similar to the manner in which the triple piston responds to lighter reductions in the train pipe.

In an emergency application, piston 19 travels to its uppermost limit, carrying with it slide valve 23, thereby permitting train pipe pressure to discharge quickly through the direct lower opening in the brake valve body, and also through the graduating valve and slide valve which are in communication with the upper port for exhausting air from the train pipe.

It will be easy to see the growth of the present standard equalizing discharge valve from this valve.

G. B. Culver.

High Bridge, N. Y.

Improved View of Slide Valve Feed Valve.

The cuts of the slide valve feed valve attachment to the brake valve, have always been more or less difficult to understand, owing to the fact that the ports and passageways for this device run in two different directions, it therefore, being impossible to illustrate clearly in one drawing these passage ways.

The drawing shown in Fig. 1 and Fig. 2 are made to illustrate more clearly the operation of this device, and the drawings have been made so that all ports lie in one plane. Fig. 1 shows the slide valve in its normal position, closing port *b*, and permitting the feed valve *a* to be closed, thereby rendering the attachment imperative.

Fig. 2 shows the slide valve uncovering the port *b*, which permits the pressure in passageway *i* to escape to the train pipe, thereby causing the spring, 67, in the spring case to push the fed valve *a* from its seat. These two drawings should make the study of the slide valve feed valve attachment much easier and clearer.

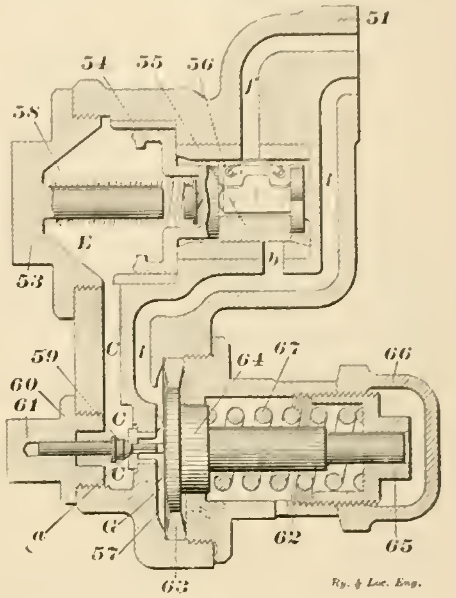
L. E. Harris.

Cincinnati, Ohio.

Air Pump Failures.

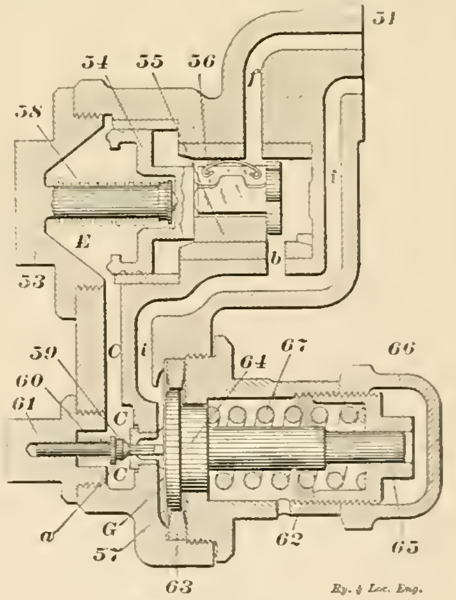
One of the causes that lead to air pump troubles, and to which there has not been as much attention paid as there should have been, is the care of the pump after the engine has been left on the roundhouse tracks at terminals.

With the triple feed lubricator, oil must necessarily be cut off from the air pump when the cylinder feed and steam connections to lubricator are closed. The universal practice of closing the lubricator is necessary, but as a rule, the air pump is allowed to run, and continues to do duty until the hostler has disposed of the locomotive, when the pump throttle is closed.



ONE PLANE VIEW OF THE FEED VALVE ATTACHMENT (CLOSED).

When the final disposition of the engine is made and pump shut off, how many of our hostlers open the drainage cocks attached to the steam chambers of the pump? From what knowledge the writer has been able to acquire regarding the matter, it is one of the things that are universally neglected.



ONE PLANE VIEW OF FEED VALVE ATTACHMENT (OPEN).

After enginemen leave the engine, it may not be more than thirty minutes before the hostler has the engine housed, and it may not be less than ten hours. All this time the pump keeps churning

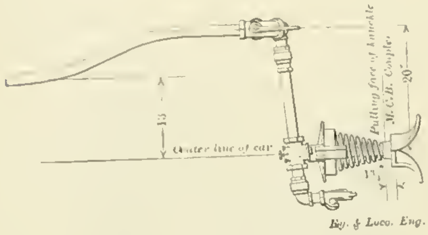


FIG. 4

away without lubrication. When the pump throttle leaks some, which most of them do, and drainage cocks are left closed, condensation soon fills the steam chamber of the pump, and all traces of oil having disappeared, we soon have a beautiful coat of rust on all of the inside wearing surface. There is no guess-work about this statement, as the writer has made personal investigation.

When enginemen again take charge of the engine, they may, and they may not, open drainage cocks. When the throttle is opened to a greater or less amount, the pump finally starts, after making as much complaint and as many groans as an old man with the gout. After a time varying from a few minutes to a half hour, the engineer will get his triple feed lubricator in operation, by which time the rings in the main reversing and steam pistons have again polished their wearing surfaces, and had more real wear than they would get in an

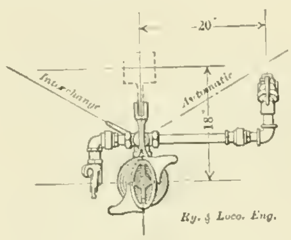


FIG. 6.

entire trip over the road, or an actual service of not less than twelve hours where good lubrication is kept up.

The triple feed lubricator is a "hoodoo" for the air pump, and when the mechanical departments go back to the separate lubricator, they will eliminate one of the causes of the expense in air pump maintenance. The triple feed lubricator or any cylinder lubricator must necessarily be closed at just such times when it is often a necessity to have the air pump in operation, and with the separate lubricator there need be no time when the pump is in service when it could not get the oil necessary to save the wearing surfaces.

J. W. READING.

Grand Rapids, Mich.

The Forsyth Automatic Brake Pipe Coupler for Freight Cars.

In the January, 1905, number of RAILWAY AND LOCOMOTIVE ENGINEERING, the Forsyth automatic train pipe coupler for passenger cars is illustrated and described. In this number is illustrated the same coupler, modified to apply to freight cars. The description given in the January number of the operation of the passenger coupler applies to the freight coupler as well.

The modifications necessary in the coupler to adapt it to service on freight equipment consists simply in the elimination of the air signal and the steam heat pipe connections from the coupler head, and in the addition of an ordinary hose coupling and special two-way cock, placed in the brake pipe to facilitate the interchange of cars and the coupling of the ordinary brake-pipe hose coupling to the Forsyth coupler.

The method of attaching the automatic coupler head to the car coupler, shown in the accompaying illustrations, is different from that shown in the illustrations in the January number. That shown in the January number, employing a combined brace and hanger, is for use in applying the automatic train pipe coupler to cars already built, or where car couplers are not provided with the necessary lug, as shown in the illustrations.

The special two-way cock has two positions, as shown in Fig. 6, one for interchange, when an ordinary hose coupling and an automatic train pipe coupler come together, and one for automatic; that is, when two automatic train pipe couplers come together.

There is no intermediate or lap position to which the special two-way cock can be turned that will close the brake-pipe passage to both the hose and the automatic coupling; hence, trainmen cannot make a mistake in manipulating it. For when a hose is coupled to the "glad hand," as trainmen have already termed the special coupling on the automatic coupler, the two-way cock must be turned to direct air to the hose coupling before the angle cock is opened; or, if not, air will escape through the automatic coupler to the atmosphere, and apply the brakes; and vice-versa, when two automatic couplers are brought together, the handle must be turned to the automatic position, or brake-pipe air will escape through the hose coupling to the atmosphere, and apply the brakes.

When all cars are equipped with the automatic train pipe coupler, the "glad hand" will not be necessary, and may then be removed from the automatic coupler.

J. P. KELLY.

Watertown, N. Y.

Locking Plate for Reversing Plate Bolts.

Those who are having trouble with loose reversing plate bolts, or rather, with their becoming loose while in service and causing pump failure, will find a remedy, or in fact, a cure, by use of the copper plate shown in accompanying sketch.

The plate is made from sheet copper, about 3/64 in. thick, and of sufficient outside dimensions to be substantial, but still not bulky. This piece of copper is placed on top of the reversing plate, and the reversing plate bolts inserted in their proper places through holes *c* and *d*. After the bolts have been tightened the ends *a* and *b* of the plate are bent

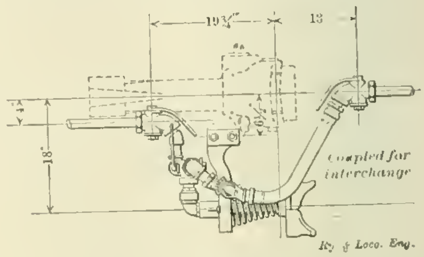


FIG. 5.

up along the side of bolt heads, and then filed off even with same.

The hole *e* in center is of large enough diameter to accommodate end of reversing valve bushing in pump head so that there is no possibility of pump pounding, caused by piston striking bushing, on account of increased thickness, should the copper extend across the plate having only hole of sufficient diameter to admit reversing valve rod.

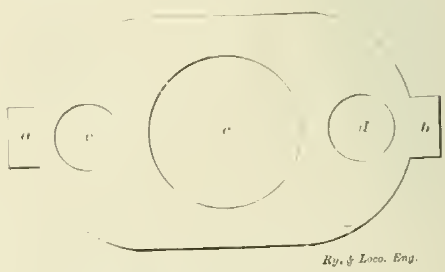
This idea has been made use of for some little time by the Chicago & Alton Railway in all their pumps—New York, 9½ in. Westinghouse and 8 in. Westinghouse—and, as mentioned, has been a complete cure of this difficulty.

E. O. PALMER, Foreman A. B. Dept.
Chicago & Alton Ry.

Bloomington, Ill., 805 N. Mason street

Triple Valve Bushing Roller.

I am sending you a drawing of a triple valve bushing roller, which I know

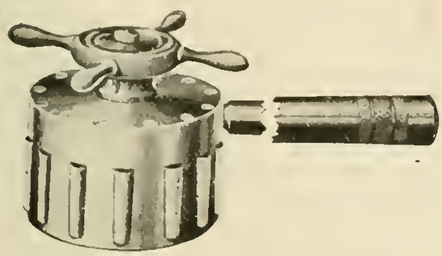


REVERSING PLATE BOLT LOCK.

will be interesting to your air brake readers.

This tool consists of a cylindrical case of steel, in the periphery of which is recessed a number of hardened steel taper rollers which are forced out, or allowed to recede, by means of a conical center, operated by a screw at the top. In whichever direction the rollers are made to operate, the outer or rolling forces are always on a plane parallel with the axis of the tool, and since each roller must move at an equal distance from the axis, it follows that the bush must be a true cylinder after rolling. All wearing parts are tool steel hardened and ground.

The simplicity of the tool makes it a necessity in the air brake department of a railroad, as it puts the bushing in perfect condition at the expense of only a few cents. The bushing is left in a better condition to resist wear, as the action of the roller on the metal is to make it denser and to produce a bur-



TRIPLE VALVE BUSHING ROLLER.

nished finish to the surface of the bushing, thereby making it harder and better capable of standing more service without showing wear than the bushing which has not been rolled.

H. G. Hammet.

Troy, N. Y.

Some Hints on Air Pump Maintenance.

There is no reasonable excuse for an air pump failing to work, or keep up the required amount of air pressure on the road, providing train pipe leakage is followed up and taken care of. It is necessary that round-house repairmen shall be up-to-date, not only in making repairs quickly and accurately, but also in recognizing parts of the air-brake apparatus that have a tendency to produce the same disorder as that reported. There are hundreds of competent air-brake men working in round-houses and shops, but they are never looking for work which is not reported.

When an air pump fails, some one is responsible. It may be the engineer, inspector, repairman or hostler who is to blame. If the engineer has done his duty, the pump will not be run dry or at an unnecessary high speed. If the inspector is a competent man, the pump will not pass him with loose main pistons, loose valve seats, or badly worn parts. If the hostler takes any care in starting the pump, and in keeping it running at ash pit, etc., the main pistons will not be pounded loose, or small packing rings be broken.

There are several patent lock nuts for the main piston rod that will not let the nuts work loose; and if the end of the rod is annealed when the pump is overhauled, the rod will not break off. There are several ways of fastening reversing plate bolts so they will not come out, even if they do work loose; and if the pump is oiled and not run with water pressure, the bolts will not be torn out, or packing rings in main valve be broken, nor the end of main valve itself be torn off if put together properly.

Under the same conditions, the reversing valve rod will not be put in when the hollow in main piston is not deep enough.

Steel air valves will not break, neither will they stick if oil is put in the air cylinder through the oil cup, instead of the air strainer, nor will the packing rings be broken.

There are several different kinds of air pump packing that will not burn out, one kind in particular that is practically indestructible, which will stay in the pump until it is worn so the gland will not longer touch it, when another piece can be added and will give the same service as new packing. If the pump should get hot and burn the packing hard, a small quantity of oil will soften it, and not render it any more liable to burn out than new packing. This practice has been successfully carried out on locomotives hauling heavy trains equipped with the high speed brake, and pumps pumping 130 lbs. air pressure.

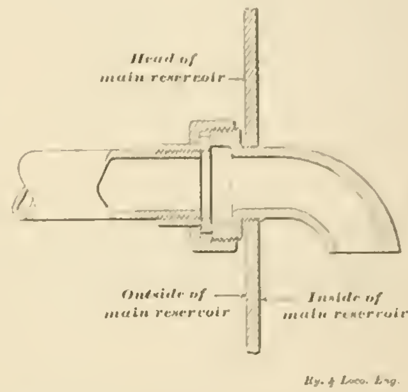
Pumps run 18 hours or more a day, and stay on the engine from 6 to 12 months. These pumps are taken off at the end of 6 months' service, if they can be replaced, and no repairs are made on the engine if it can be avoided.

Some railroads have annoying air pump failures, and will continue to have them so long as the air-brake instructors are content to do no more than write letters from the office and ride over the road in the instruction car. Air-brake instructors would doubtless find something to their advantage in making an occasional visit to the engine-house and observe the habits and practices the workmen and engineers are liable to fall into.

G. W. Kiehm, A. B. Repr'm'n.
Penn. R. R.

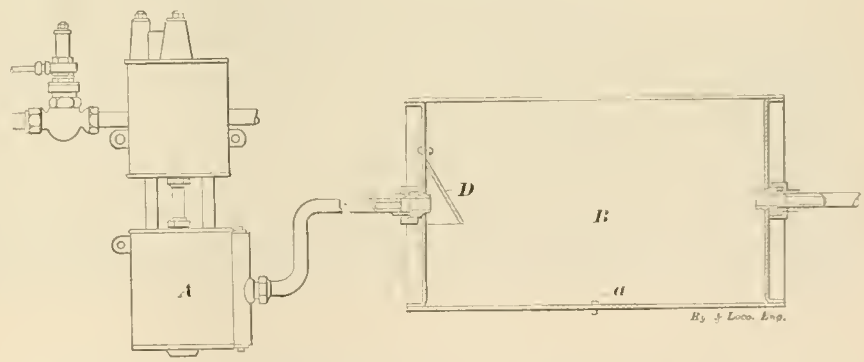
Washington, D. C.

The proceedings of the eleventh annual convention of the Air Brake Association may be obtained in this office for 75 cents, paper bound, and $1.00, leather bound copies. These books keep pace with their predecessors in reference to containing good and useful information which no air brake man can afford to be without.



BENT DELIVERY PIPE CONNECTION, DESIGNED TO DEFLECT MOISTURE AND PREVENT IT GOING BACK INTO TRAIN PIPE AND TRIPLES.

For some days last month there appeared to be a likelihood that the firemen belonging to the New York, New Haven & Hartford Railroad, would go out on strike. They claimed the right to represent their members who are engineers direct with the management when such men were charged with any offense. The management of the road asserted that they had an agreement with the Brotherhood of Locomotive Engineers to permit that organization the exclusive right of attending to the grievances of engineers and they would not consent to the request made by the firemen. The incident has aroused considerable hard feeling on both sides.

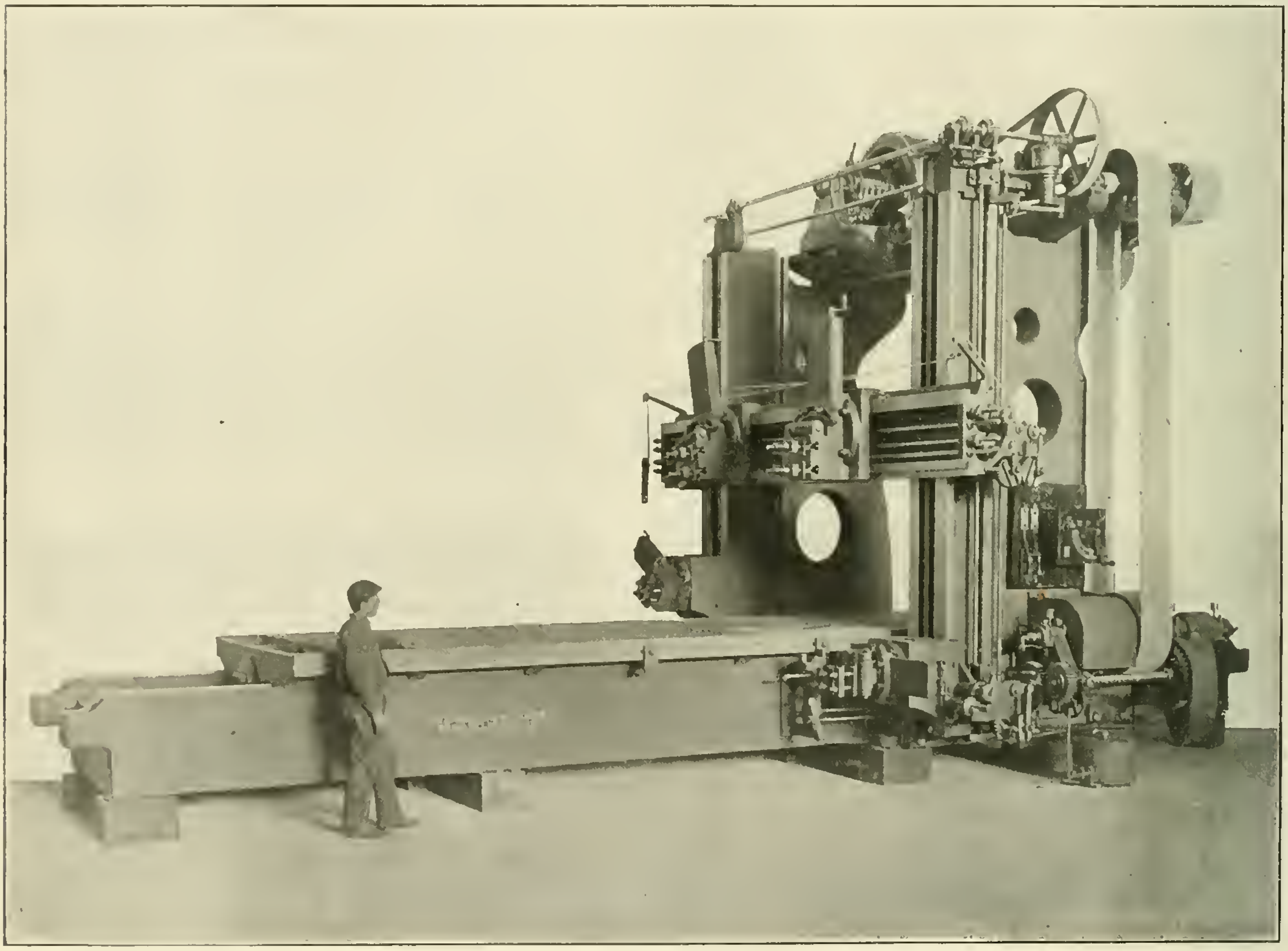


DEFLECTOR PLATE, DESIGNED TO CREATE GREATER CIRCULATION OF AIR IN THE MAIN RESERVOIR AND PREVENT MOISTURE FROM PASSING BACK INTO THE TRAIN PIPE. INVENTION OF MR. EUGENE BEARSS.

96-Inch Planer, With Friction Clutches, Operated by Air.

Planer illustrated, made by William Sellers & Co., Philadelphia, is intended for work not exceeding 96 ins. wide, 96 ins. high and 20 ft. long. It is provided for two cutting tools on the cross rail and one on each of the housings. Each of the two saddles has its own feed motion, independently adjustable in direction and amount. Each has also its own stopping and starting device, but the planer is so arranged that all of these can be thrown out of action or into action simultaneously, by the motion of a hand lever, and this can be done from either side of the planer. The table has a constant return speed of 80 ft. a minute, and a variable cutting speed from 15 ft. to 45 ft. a minute. The table is supported in one flat and one V-bearing, which are provided with forced system of lubrication by means of pump with circulating pipe system, oil tank and filters. The V-bearing has four surfaces, two forming a V of large angle, sufficiently inclined to guide the table under ordinary circumstances, but having the minimum wedging action. There are also two nearly vertical sides which do not bear under ordinary circumstances, but are ready to resist side cuts which are sufficiently heavy to slide the table up on the V so as to bring the vertical surfaces in contact. This arrangement permits the table to run lightly under ordinary work, but prevents it from lifting under any condition of heavy side cutting. The table rack, 2¾ in. pitch, 10 in. face, is driven by a spiral pinion of 5 threads.

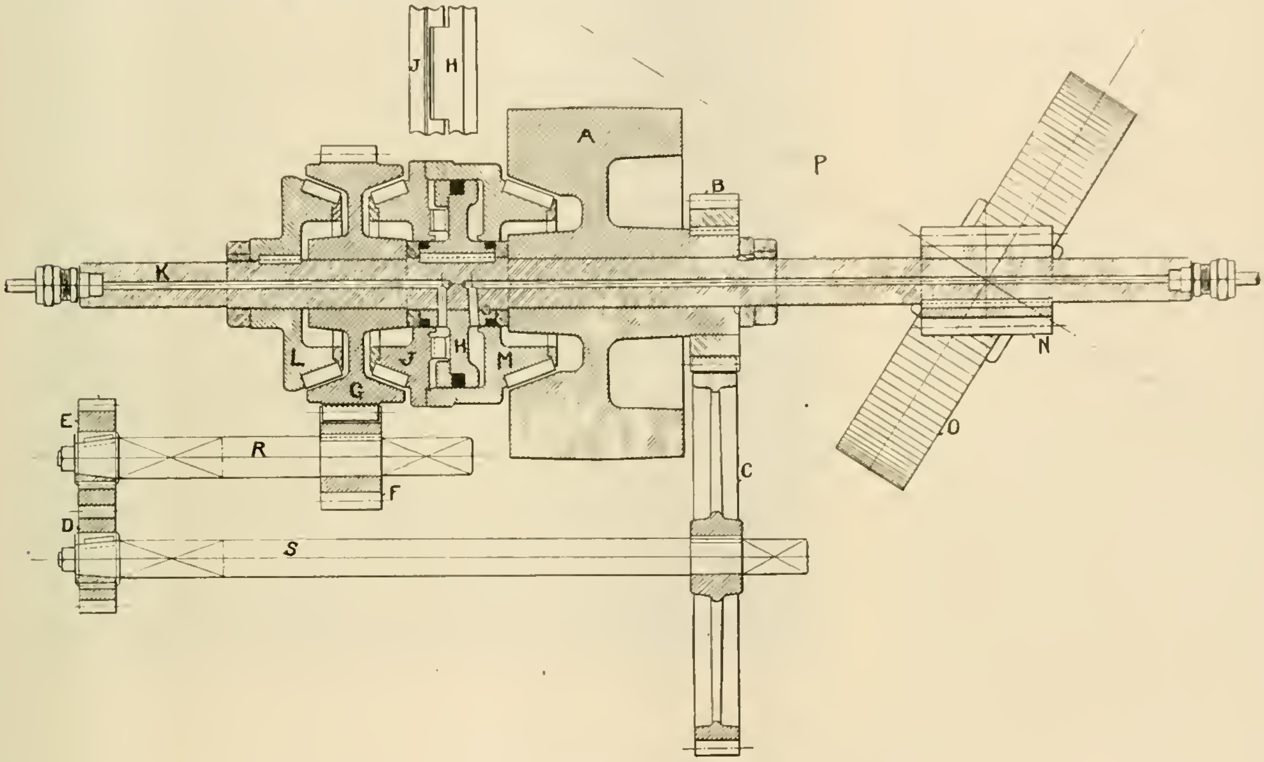
The driving and reversing mechanism is shown diagramatically in Fig. 3. "P" represents the shaft which carries the spiral pinion driving the table. On its outer end is mounted a spur wheel "O." This is driven by the spiral pinion "N" on the pulley shaft. The driving pulley "A" runs loose on the pulley shaft "K." It runs continuously and in the same direction while the planer is in operation. On the hub of the pulley "A" is a pinion "B" driven through a reducing train of wheels, C, D, E and F, to a loose wheel "G" mounted likewise on the pulley shaft. It is evident that the wheel "G" will run in the opposite direction to the pulley "A," and at a reduced speed, depending upon the ratio of the gears in the train. The pulley "A" is turned on one side to form female half of a conical friction clutch. The wheel "G" is turned on both sides in a similar manner. "J" and "N" are two conical male elements bolted together and forming an air-tight cylinder free to move back and forth on the disk "H," which is keyed and pinned to the shaft "K" and forms a piston in the cylinder. In order to compel the shaft to rotate with the friction clutch the head of the cylinder "J" is provided with notches into which project teeth on the surface of the piston "H." These form a jaw clutch and permit end movement, while they compel the parts to rotate together. Air admitted to one end of the cylinder through the center of the shaft "K," for example, between the parts "H" and "M," will cause the cylinder to move in the direction of the pulley "A" and to press the friction cone against the pulley so as to cause the clutch to rotate with the pulley. This movement will be transmitted through the piston "H" by the clutch teeth, and cause the shaft to rotate in the same direction, which produces a return



SELLERS 96-INCH PLANER. FIG. 1.

movement of the table. Admitting air to the opposite end of the shaft will cause the clutch "J" to engage with the wheel "G" and to force the latter against the stationary clutch "L," which is keyed to the shaft so that the wheel "G" drives the shaft through both of the clutches, one on either side, in the proper direction for cutting at a speed which may be varied by changing the gears "E" and "D." These are mounted on split bushings with conical holes, which permit the gears to be shifted with the minimum amount of trouble. In the operation of the planer the table stops move an air valve which admits compressed air alternately to the opposite ends of the cylinder, and by regulating the velocity of the admission the speed of reverse can be nicely gauged. It is arranged so that plished through a positive motion clutch, which is stopped and started at each reverse of the table. The movement of the table dogs not only actuates the air valve, but it trips the escapement train in the feed motion, and allows it to make half a revolution. This gives a half turn to each of the crank disks, transmitted from the clutch through a square shaft on the side of the housing, by bevels to a horizontal shaft driving a similar square shaft on the left-hand housing. Each of these disks, having a half turn at each reverse, the amount of feed is determined by the position of the crank. The work done by the dogs, it will be seen, is of the lightest character, and the shifting by hand is also easily accomplished. A novel feature of the side heads is that they are lifted by of the successive finishing cuts occurred in a practically true vertical line, as can be readily seen in the illustration.

Another novel feature about this planer is the manner in which the cross rail is secured to the uprights. The back between the uprights is extended in a rectangular form, with two vertical surfaces fitted with gibs to the inside surfaces of the uprights or housings. A flange on the back of the cross rail extension is provided with bolts working in T-slots in the inner faces of the uprights. Tightening these bolts draws the uprights against the cross rail, which is also secured to the face of the uprights in the ordinary manner. This method of bolting brings into play the strength of the housing to resist the torsion of the cross rail, and the



DRIVING AND REVERSING MECHANISM OF SELLERS PLANER FIG. 2.

the table is brought to rest promptly and started up in the opposite direction without shock. There is no reversal of high speed pulleys and the flywheel action of the parts whose motion is reversed, owing to their relatively small size, is reduced to the minimum. The pulley "A" may be driven through a countershaft in the ordinary manner, or from a motor as in the present instance, where the 50 h.p. motor is mounted on a cast iron platform carried on brackets from the housings, and which serves as a cross girt between them The motor drives by horizontal belt to a countershaft, which in turn drives the pulley shaft at the base of the housing. A separate belt is used to actuate the lifting gear and drive the feed motion The latter is accom-

the same screws which carry the cross rail. These screws are stationary under ordinary circumstances, and the heads are raised and lowered by rotating the nuts. It is found in practice that this form of clutch releases and engages with gre t regularity and very promptly, so that the stroke of the planer is remarkably uniform, the reverse taking place at the same point, and the overrun at the beginning of the stroke is only sufficient to allow the feed to act. Fig. 2 shows a casting which has been planed on one side with a heavy roughing out, the tool being held in one of the side heads. A square nose finishing tool was then substituted and the stroke shortened so that the cut terminated within the surface of the casting The stopping point

cross rail stiffens the housing against the twisting action of the side heads. The effect is an enormous increase in the strength of the combined parts, and unusually heavy cuts can be carried.

In some 54 in. planers of this construction, two cuts of 60,000 lbs. each were taken in steel, without any perceptible spring of the cross rail, although it was scarcely larger than what is usually provided for a planer of that width.

The total weight of the planer is about 60 tons.

Italy is adopting a scheme comprising the cutting of 2,141 miles of canals, some of which are to take ships of 600 tons.

Steel Mail Cars.

Three steel railroad mail cars have been placed on the Consolidated road for service between New York and Boston. They are very handsome cars and combine great strength with comeliness. It is expected that the great shock-resisting power of the cars will make life in a mail car safer than it is at present. One of the main features is the closed stub end vestibule with a diaphragm so that when in a train no one can board the cars. They are also the first mail cars to carry a six-wheel truck and the cars are built in strict accordance with the government specifications.

Inside the cars there is a mail distributing department, an assorting department, and a storage department. They are also fitted with the Kendall reversible assorting tables and the Harrison racks for pouches. There are two large doors on either side which greatly facilitate the work of transferring the mail.

Fate of American Locomotives in Bavaria.

The Bavarian Government bought a lot of American locomotives some years ago, and it was frankly asserted at the time that the purpose of the purchase was to watch the working of the engines and appropriate the features that proved better than those used on German locomotives. Intimation is now given that the American locomotives are to be abandoned, but the officials fail to say that the engines have served their purpose. Instead of that they make the sneaking charge that the American locomotives have not been satisfactory.

German engine builders were intensely hostile to the use of our engines in Bavaria, as the British engine builders have been intensely hostile to their use in India, Egypt, Africa, Australia and Jamaica, not to speak of neutral markets. Yet our engines have met the competition of English and German engines in all quarters and have with rare exceptions proved their equality and generally their superiority. In Jamaica they surpassed engines built in England after special designs to fit the conditions of the island.

Three years ago the Bavarian Government acquired some of the American patents and ordered two locomotives built on the American plans, with some modifications, in German machine shops. The abandonment of American locomotives probably means the imitation instead of the purchase of American engines.

Lifting by Magnetism.

Many of the large shops throughout the country which have the work of handling of steel plates in large quantities have resorted to magnetism as a means of lifting the weights. Plates weighing from four to even twelve tons are successfully lifted by the aid of electro-magnets suspended by chains from cranes and overhead hoists. The magnets are encased in a substantial iron frame with a heavy eye-bolt fastened in the back, through which the crane hook is passed. The magnets lift by simple contact when the electric current is on, and the time otherwise necessary for the adjustment of hooks and chains is saved, consequently more plates can be handled per day by this method than by the old way. Another point about the magnetic lift is that plates too hot to be touched by men can readily be lifted by the invisible force of the electric current and carried to their appointed place, there to cool at leisure. A magnet weighing 300 lbs. can lift a plate weighing about 9,000 lbs.

An agitation is going on in Pennsylvania to abolish the obnoxious blue laws, which make it a crime to do any work on the Sabbath day. If these laws were strictly obeyed no railway trains could be run on Sunday and a great deal of other work now a necessity in modern conditions of life would have to be stopped. Voters in the State are urged to favor the repeal of the laws. A strong argument used on Philadelphia people is that strict enforcement of the laws would lead to the closing of the Baldwin Locomotive Works

A Palatial Street Car.

A particularly handsome palace car has just been put into service on the Dayton & Troy trolley railroad, which indicates the progress making by certain trolley lines to compete with steam railroads. The car is 60 ft. in length, built on the steam passenger coach style, and is several inches wider than the ordinary traction car. The car carries four 250 h.p. motors. Sleeping accommodations for 40 passengers can be furnished, and the car is provided with nearly 30 plush parlor car revolving chairs. The car is well heated and lighted, and is provided with every late improvement. The car can be speeded up to 70 miles an hour. It was constructed by the Harlan & Hollingsworth Company, of Wilmington, Del.

WORK DONE ON SELLERS PLANER. FIG. 3.

The executive committee of the New York State organization of the Brotherhood of Locomotive Engineers at a meeting in Albany last month adopted a resolution asking for the inspection of locomotives by the State. The request results from the recent explosion of a locomotive that wrecked two trains and killed two men at Whitesboro, on the New York Central.

The whole coast of Peru is positively rainless, and is chiefly barren desert. The region between the first and second cataracts of the Nile, however, is supposed to be the hottest in the world It is also rainless.

Of Personal Interest.

Mr. W. S. Templeton has been appointed superintendent of motive power and equipment of the Ferro Carril Central de Guatemala, with headquarters at Guatemala City, Guatemala, C. A.

Mr. Walter Dunbar has been appointed general foreman on the Guatemala Central Railroad, with office at Guatemala City.

Mr. Thomas Lawson has resigned as a director and manager of the Lawson Car Company, and has connected himself with Mr. George I. King, of the Middletown Car Works, in the manufacture of the King-Lawson Dump Car, office 32 Broadway, New York City, N. Y.

Mr. M. D. Franey has been appointed superintendent of the Collinwood shops of the Lake Shore & Michigan Southern Railway.

Mr. W. E. McEldowney has been appointed master mechanic of the Denver, Enid & Gulf, with office at Enid, Okla.

Mr. E. G. Haskins has been appointed acting master mechanic of the second and third districts of the Denver & Rio Grande, with headquarters at Salida, Col., vice Mr. C. A. Hinckley, resigned.

Mr. W. O. Johnson has been appointed general foreman of machinery and equipment of the Manistee & Grand Rapids, with office at Filer City, Mich. Mr. Johnson was formerly master mechanic on the Iowa Central.

Mr. A. C. Hinckley, formerly master mechanic of the Denver & Rio Grande, at Salida, Col., has been appointed master mechanic of the Cincinnati, Hamilton & Dayton, with office at Lima, Ohio, vice Mr. J. E. Gould, resigned.

Mr. W. L. Tracy, formerly assistant master mechanic of the Louisville & Nashville, at Louisville, Ky., has been promoted to the position of master mechanic of the same road at Louisville, Ky.

Mr. W. A. Stearns has been appointed assistant master mechanic of the Louisville & Nashville, at Louisville, Ky., vice Mr. W. L. Tracy promoted.

Mr. D. P. Angell, formerly assistant road foreman of engines on the Baltimore & Ohio, has been appointed assistant trainmaster on the same road, with office at Connellsville, Pa., vice Mr. H. R. Hanlin, promoted.

Mr. B. C. Thompson has been appointed assistant road foreman of engines on the Baltimore & Ohio Railroad, vice Mr. D. P. Angell, promoted.

Mr. M. Penderghast has been appointed general foreman of the Baltimore & Ohio shops, at Fairmont, W. Va.

Mr. F. Mertsheimer, who has been appointed superintendent of motive power of the Cincinnati, Hamilton & Dayton Railway, begun his railroad work in 1869. He entered the service of the Union Pacific and became assistant foreman of shops, and later general foreman. From that road he went to the Colorado Central as master mechanic, and from 1880 to 1886 he was superintendent of motive power of the Texas Pacific. He later on returned to the Union Pacific as master mechanic, at Armstrong, Kan. He

MR. F. MERTSHEIMER.

held the position of superintendent of the Wyoming Division on the Union Pacific, also assistant superintendent of machinery, and also that of master mechanic until the year 1897, when he took the position of superintendent of machinery on the Kansas City, Pittsburgh & Gulf. He became general superintendent of that company and served in that capacity from 1897 to 1899. In 1902 he was appointed superintendent of machinery on the Denver & Rio Grande. Mr. Mertsheimer's office on the C., H. & D. is in Lima, Ohio.

Mr. Samuel G. Strickland, superintendent of the Nebraska Division of the Chicago, St. Paul, Minneapolis & Omaha Railway, has been appointed general superintendent of same road, vice Mr. W. C. Winter, resigned. Mr. Strickland's office is at St. Paul, Minn.

Mr. L. B. Thornburgh has been appointed sales agent of the J. L. Bordo Company, of Philadelphia. He is in charge of the railroad department. The Bordo Company is manufacturing the Bordo Blow-off Valve and the Bordo Swing Joints. Mr. Thornburgh was formerly general sales agent of the Shelby Steel Tube Company, and lately vice-president, treasurer and manager of Miller, Thornburgh & Company, of New York.

Mr. H. C. Bayless has been appointed mechanical engineer of the Minneapolis, St. Paul & Sault Ste. Marie, with office at Minneapolis, Minn.

Mr. Henry M. Sperry has resigned his position of New York agent of the Union Switch & Signal Company. Mr Sperry began active railroad work in 1889 on the Pennsylvania Railroad For the first four years he was with the engineer corps and from 1884 to 1891 he was supervisor of signals on the New York Division, and was in charge of construction and maintenance while the line from Philadelphia to New York was changed from two to a four-track system. This change necessitated the construction and installation of a large number of interlocking plants. Later Mr. Sperry became the general agent of the Johnson Railroad Signal Company and had general charge of the block signaling on the New York Central. He subsequently became signal engineer and agent of the National Switch & Signal Company, in charge of the western district. While with that company he was called upon to design a large interlocking plant of 157 levers at State Line, Ind., and he installed the signal system of the elevated Railroads of Chicago. From 1899 to the present time he has been signal engineer and agent of the Union Switch & Signal Company.

Mr. George Hoeffle has been appointed master blacksmith of the Southern Railroad shops at Knoxville, Tenn.

Mr. L. L. Collier has been appointed master mechanic of the Newton & Northwestern Railroad, with headquarters at Boone, Iowa. Mr. Collier was formerly master mechanic of the Arkansaw Southern, at Rushton, La.

Mr. S. A. Baker has been appointed Canadian freight and passenger agent of the Chicago Great Western Railway, with office at Toronto, Ont., vice Mr Thomas Ridgedale, resigned.

Mr. J. W. Leonard has been appointed manager of construction of the railway between Sudbury and Toronto, which is being constructed by the Canadian

Pacific Railway. Mr. Leonard's office is at Toronto.

Mr. John McGarvey has been appointed superintendent. Rochester and Buffalo Divisions of the Buffalo, Rochester & Pittsburgh Railway, with headquarters at Rochester, N. Y.

Mr. A. H. Kean, who some time ago resigned as general foreman of the B. & O. shops, at Newark, Ohio, has accepted a similar position at the Forty-seventh and Wentworth avenue shops of the C., R. I. & P., at Chicago.

Mr. William H Keffer has been appointed assistant superintendent, Read- and Lebanon Divisions of the Philadelphia & Reading Railroad, with office at Reading, Pa.

Mr. Frank Roach has been appointed trainmaster of the South Platte and Omaha district of the Chicago & Northwestern Railway.

Mr. Richard Koehler has been appointed general purchasing agent of the Oregon Railroad & Navigation Company, with headquarters at Portland, Ore. The office of purchasing agent and the office of manager Southern Pacific Company's Lines in Oregon has been abolished.

Mr. F. L. Blendinger has been appointed purchasing agent of the Lehigh Valley Railroad, with office at 228 South Third street, Philadelphia, and 143 Liberty street, New York.

Mr. C. C. F. Bent has been appointed general superintendent of the Baltimore & Ohio Railroad, with headquarters at Baltimore, Md., vice Mr T. Fitzgerald, promoted.

Mr T. Fitzgerald has been appointed general manager of the Baltimore & Ohio Railroad, vice Mr C. S. Sims, resigned.

Mr. Thomas F. Brennan has been promoted to the position of superintendent of transportation of the Buffalo, Rochester & Pittsburgh, with office at Rochester. The office of general car agent has been abolished. All communications heretofore addressed to general car agent should be sent to superintendent of transportation.

Mr. H. B. Voorhees has been appointed superintendent and general agent of the Baltimore & Ohio Railroad, with headquarters at Philadelphia, Pa., vice Mr. C. C. F. Bent, promoted

Mr. J. J. O'Neil, formerly traveling engineer of the Wisconsin Division of the Chicago, St. Paul, Minneapolis & Omaha Railway, has been appointed assistant superintendent of the M. & I. Division, with office at St. James, Minn.

Mr. James M. Gruber has been appointed general manager of the Chicago, Burlington & Quincy, vice Mr. F. A. Delano, resigned. Mr. Gruber entered railway service when he was 17 and held the position of clerk and stenographer in the general office of the St. Paul, Minneapolis & Manitoba, and he also held a similar position for three years in general manager's office on the same road. He was later connected with the Atchison, Topeka & Santa Fe, and held several positions on that road. He severed his connection with the Santa Fe to become general manager of the Montana Central. In March, 1897, he was given the appointment of assistant general superintendent of the eastern district of the Great Northern. His next promotion was the position of general superintendent of the Chicago, Rock Island & Pacific. In 1904 he went to the Union Pacific as general superintendent, and he now becomes general manager of the Burlington system.

Mr. T. W. Kennedy, assistant superintendent of the Minnesota and Iowa Division of the Chicago, St. Paul, Minneapolis & Omaha, has been appointed superintendent of the Wisconsin Division of the same road, with office at St. Paul, Minn., vice Mr. W. Bennett, resigned.

Mr. Elliot E. Nash, local agent at Minneapolis, on the Chicago, St. Paul, Minneapolis & Omoha, has been appointed assistant superintendent of the Wisconsin Division of the same road, with office at Itaska, Wis.

Mr. F. E. Nicholes, assistant superintendent of the Wisconsin Division of the Chicago, St. Paul, Minneapolis & Omaha, has been appointed superintendent of the Nebraska Division of the same road, with office at Omaha, Neb.

Mr. B. A. Worthington, who recently held the position of assistant director of maintenance and operation on the Harriman lines, has been appointed general manager of the Oregon Railroad & Navigation Company, with headquarters in Portland, Ore., vice Mr. E. E. Calvin, transferred. Mr. Worthington has been with the Southern Pacific since 1874. He began his railroad career as a telegraph operator on the Central Pacific and later became chief operator with that company and the Western Union Telegraph Company. In 1882 he was made chief clerk to the general master mechanic of the Central Pacific at Sacramento, and after holding that position for about eight years be became chief clerk and secretary to Mr. A. N. Towne, vice-president and general manager of the Southern Pacific at San Francisco. Later he was appointed secretary to Mr. H. E. Huntington, assistant to the president In 1889 Mr Worthington was given charge of the tonnage rating of locomotives on the Southern Pacific. He subsequently became superintendent of the Tucson Division of that road and later he was transferred to the Coast Division. He was appointed assistant to the general manager in August, 1903, and in April of the next year he was appointed to the position he now leaves to become general manager of the O. R. & N. Company.

Mr. I. L. Hibbard has been appointed general superintendent of Coast Lines of the Atchison, Topeka & Santa Fe, with office at Los Angeles, Cal. He began railroad work on the Erie in 1873, when he worked as assistant yardmaster at Elmira, N. Y. His next move was to become clerk in the general eastern office of that road. He was subsequently clerk and stenographer in the St. Louis office of the Indianapolis & St. Louis. He next held the position of trainmaster on the Chicago Division at Forrest, Ill. In March, 1890, he accepted the position of trainmaster on the Southern California at San Bernardino, Cal., and later became superintendent of the Albuquerque Division of the Santa Fe at Winslow, Ariz. He was transferred to the Los Angeles Division of the same road, where he remained until appointed general superintendent of the Santa Fe Coast Lines.

The Monarch Railway Supply Company, of Detroit, have changed their name to that of the Frost Railway Supply Company. Henry Frost is president of the company and the temporary offices of the company are in the Majestic Building, Detroit.

Here is a true sketch written by a patronizing idiot for *Leslie's Weekly* about a prominent railway manager: "The elevated railroads carry some two hundred million passengers a year. The estimated capacity of the subway is one hundred and twenty-five millions. The direct responsibility for the safety of these three hundred and twenty-five million people rests upon Frank Hedley, the general manager. If there are accidents, such as that in the Paris underground, he will be held to blame. Individually he has solved the thousands of problems incidental to opening the road; has assigned to his twelve thousand subordinates—engineers, superintendents, motormen, guards, ticket sellers, ticket choppers and what not—their appointed tasks; has co-ordinated all branches into a smooth running organism—without any fuss, or any outward manifestation that he was doing the unusual. More than this, he is a broad-minded man; is interested in other things than subways; has emerged from the ranks of workingmen and left most of his native roughness behind, and, among other things, speaks excellent English. According to the newspapers, his salary is $25,000 a year." "Left most of his native roughness behind forsooth." Roughness was never a part of Frank's nature or habits. While working at the vise bench he was much more of a gentleman than the roaring jackass who writes about him with such smirking condescension.

Mr. Matthew Carey recently completed 25 years in the employ of the H. A. Rogers Co., well-known dealers in railway and machinists' supplies at 19 John street, New York City. The occasion was remembered by the company, who presented him with a silver purse with plenty of gold in it. It is memorable in an individual's life when he has served a quarter of a century for the same employers as Mr. Carey has done, and the fact is of interest as a noteworthy example of unselfish fidelity to an employer's welfare.

Obituary.

EDWARD LONGSTRETH.

Edward Longstreth, until 1886 one of the owners of the Baldwin Locomotive Works, died in Philadelphia, February 23, sixty-five years old. Mr. Longstreth was a descendant of Bartholomew Longstreth, who came from Longstreth Dale, Yorkshire, England, and he was born on the Longstreth homestead in Bucks county, Pa. He began a five years' apprenticeship at the Baldwin works in 1857 and before four years had elapsed he had become a foreman of one of the shops. He exhibited energy and studiousness and developed great inventive ability. He developed and perfected the gauge system which is now the characteristic feature and a most important factor in the success of the Baldwin works. In 1867 he was made general superintendent of the works, and in 1870 he became a partner, retaining entire control of the mechanical and construction department with a force of three thousand men. He was the youngest and one of the most important members of the firm. He retired from business in 1886 with impaired health. His fortune made in the locomotive business had been increased by judicious investments. He had been a vice-president of the Franklin Institute and held official positions in various financial institutions. He was a Quaker, and his funeral was conducted according to the Quaker ritual.—*American Machinist.*

An Erie Problem of Train Hauling.

On February 4 Mr. J. C. Stuart, general manager of the Erie Railroad, took out a party of friends on a special trip from Jersey City to Port Jervis and back with a train of ten cars, weighing about 600 tons. The purpose of the run was to test the power of a locomotive to handle that weight of train on the fastest schedule time, which is 130 minutes for 89 miles. The division is very difficult to operate, having long, steep grades and numerous curves that prevent ordinary locomotives from making fast time, except with a light train. An engine which they offered to make the time with a 600-ton train was recently built by the Baldwin Locomotive Works, for the San Pedro, Los Angeles & Salt Lake Railroad, designed to pull heavy express trains on a hilly road. The engine is of the Pacific type, has cylinders 22x28 ins., driving wheels 77 ins. diameter, 3,054 sq. ft. of heating surface, weight on drivers 141,000 pounds and 29,920 pounds tractive power.

That is a remarkably powerful engine and worked well up to its capacity, for during the trip there was no difficulty in holding the steam up to the blowing off point, but it failed to make the time required. In fact, it lost twenty minutes on the outward trip, but made the schedule time returning.

There is a remarkably interesting contest pending in the providing of a locomotive that will haul a train of 600 tons over this mountain division of the Erie in 130 minutes. The Baldwin Locomotive Works undertake to meet the performance satisfactorily with their four-cylinder balanced compound, having cylinders 16 and 27x26 ins., 110,000 pounds weight on drivers, 3,664 sq. ft. of heating surface and 28,000 pounds of tractive power. The American Locomotive Company offer the Cole balanced four-cylinder compound with 115,000 pounds on drivers and from 29,000 to 34,000 pounds tractive power. The Erie Railroad management propose building a locomotive specially for the work. As designed, this engine has two simple cylinders 22x28 ins., the latter being 76 ins. diameter, 150,000 pounds weight on drivers, 4,000 sq. ft. of heating surface and 30,310 pounds tractive power.

From what the writer saw of the performance of the S. P., L. A. & S. L. engine he believes that none of the engines referred to will haul a 600-ton train over that 89 miles on the uphill run in 130 minutes, which is 41 miles an hour. At any rate, the work is not likely to be done by an engine with driving wheels over 6 ft. diameter. The day on which the run was made we had the temperature about 24° Fah., but there was little wind, yet the immensely powerful engine dropped down to about 25 miles an hour on the long pull up to the Ramapo water shed. When descending grades the speed had to be restrained at frequent intervals in rounding sharp curves, so that no high average could be maintained. We do not profess to be a prophet, or the son of a prophet, but we predict that the steam locomotive will never be built for a gauge of 4 ft. 8½ ins. that will haul the Erie train No. 1, weighing 600 tons, behind the tender from Jersey City to Port Jervis in two hours and ten minutes.

Port Jervis is 438 feet higher than Jersey City, but the summit of the division is 899 feet above tide water, and that rise does not by any means measure the difficulties of moving trains over the division, for about half of the route is through mountain defiles and rugged rock land, where one curve follows another in close succession. It is a picturesque country, full of scenic attractions, but hard for railroad location. If the steam locomotive appears that will haul 600 tons over that division, we wish to witness the performance.

The United States Government has succeeded in establishing a parcels post service in Great Britain. A parcels post is a service by which small packages are carried and delivered as letters are at low cost but sufficient to pay the expenses of the service. It is of immense service to poor people especially, and would be of great benefit to all classes in this country, but the Government will never be able to introduce such a system so long as the Senate is filled with men who are more interested in protecting express company monopolies than in promoting measures for the good of the people at large. Imagine the senior Senator from New York State voting for a parcels post!

A persistent legal fight between no less powerful foes than the Pennsylvania Railroad Company and the Western Union Telegraph Company has been raging for several years, and the railroad company has come out on top through a decision of the Supreme Court. The telegraph company had telegraph lines on the right of way of the railroad company in certain districts, the arrangement for the installation having been made by contract for a limited time. When the lease expired the telegraph company determined to hold possession and it has taken a long expensive fight to obtain a final decision from the Supreme Court of the United States. The telegraph company was beaten in the end.

The life of railway men in Russia who do not suit the military tyrants, who are the real rulers of Russia, is full of tribulation. Newspaper dispatches tell of a station master at Moscow who fell dead under the upbraidings of a Grand Duke who found fault about a train being late. Heart failure was given as the cause of death. The well informed people say that a rapier thrust induced the failure.

Hiring Locomotive Firemen.

At the January meeting of the Western Railway Club there was an interesting discussion of the subject of hiring locomotive firemen, following a paper by Mr. E. W. Pratt, M.M., on the Chicago & Northwestern Railway. The substance of Mr. Pratt's paper was as follows:

Where a railroad system is very extensive, the division master mechanic should be the final employing officer for firemen.

Practically all locomotive engineers have received their early training as firemen. There are, perhaps, five classes of young men from whom we may obtain our future enginemen: first, farmer boys, industrious, with a knowledge of the "three R's;" second, country boys, living in or near small towns and having an education up to the eighth grade or entrance to the high school; third, city boys with more assurance and education than industry, often turning out well, but generally needing watching; fourth, sons of railway employees, with aptitude owing to a general knowledge of the business and having better educations than their parents; fifth, technical school graduates, who usually take up the business without serious intention of sticking to it longer than convenient.

Foremen of terminal shops should have a series of blanks and number them for ready reference. When a letter is received from an applicant, form No. 100 should be mailed to him to fill out. All letters of inquiry should be answered. These application blanks should show name, where born, home address, nationality, age, height, weight, school advantages, if married or single, and those dependent on him for support, and attached to the application should be letters of reference from former employers or business men as to education and character. When more applications are needed than are on file, form No. 107 should be sent to station agents and road masters along the line.

The writer says that last fall, before hiring about seventy-five men, he had a list of over one hundred applicants, many of them experienced men, and a large number of the remainder had taken up and completed some correspondence course on combustion and locomotive firing. In this way a rapid increase of business can be accommodated without delay of traffic.

If the company does not furnish a book of instruction on firing and combustion, keep some good but inexpensive book or correspondence course on hand, recommending it to all inexperienced men and *selling it to them at cost*, if necessary.

Avoid, if possible, hiring men who are "broke." New men do not understand that the first payment does not come for over a month, and some small sum on hand may prevent garnishment of first wages and consequent discouragement.

While a few months' roundhouse experience is of advantage to boys of all classes, it should be required of those who have never even fired a stationary engine. Inexperienced men should be put to cleaning fires, hoeing ash-pans, calling, firing stationary boilers, helping the engine hostlers and firing up locomotives. This training is valuable. Helping a roundhouse machinist or the boiler washer will also be an advantage. There may even be a chance to fire a switching engine for a few hours in an emergency. The foreman should arrange to permit boys likely to be chosen as firemen to deadhead over the road two or three trips on an engine with a first-class fireman.

New firemen should not be regularly listed and given rank for the first six months of service. The older men should be given preference in work at his terminal, but not the privilege of going to some distant part of the division to displace a man a few days younger in the service. The first six months should be a season of probation. Reports should be obtained from division foremen, road foremen and traveling firemen, so as to enable the master mechanic to drop from service such men as seem unfitted to the work or likely to prove "disturbers of the peace." After dismissing these, there should be a "lay-off" list, on which the youngest man is first, men thus laid off to be reinstated on revival of business.

The Chicago & Northwestern Railway was one of the first to adopt a system of three years' progressive examinations. Failure to pass any of these results in a second trial six months later. Two successive failures drop a man from service, and no man can waive his right to promotion.

I believe the time is not far distant when leading roads will demand of applicants a knowledge of combustion and at least the theory of firing, as well as signals and flagging rules.

But the practical difficulty of to-day lies in finding men who can stand the service, due to the advent of modern coal-burning locomotives of such great size. Nor can we look for marked change of condition until mechanical stokers of successful design are extensively used.

While Mr. Pratt's paper presented many good features, which, if religiously obeyed, would prove beneficial to the service, it is nevertheless a well known fact that the framers of such rules are the first ones to break them when an unusual rush of business comes along.

The plan of putting young men in the ash-pit cleaning fires for 10 hours or more a day does not work well in practice. Such work requires no skill, and as Mr. P. H. Peck, of the Chicago Belt Line, said, "It is a fine scheme for getting rid of such men as have a 'pull' with the Aldermanic Elevating Committee, as they usually quit before the third day."

Mr. Frank P. Roesch, of the Hicks Locomotive Works, made a hit when he urged that the proper place to begin educating a young fireman was at the wooden end of the scoop.

Mr. W. E. Symons, superintendent of machinery of the Kansas City Southern Railway, said that he had known some men quite prominent in the railroad world who had been "broke," and he thought that no bar to an applicant for employment. The company should protect inexperienced men from garnishment the first month. Mr. Symons also reasoned that the best place to train a fireman was in the engine cab with a good engineer.

Mr. Jos. A. Baker said:

I fully agree with Mr. Pratt that the master mechanic should be the final arbiter in the selection of firemen, since upon his good judgment depends in a large measure the successful operation of our large locomotives.

As to the form of application blank, I must disagree with him. What matters it what a man's nationality is so long as he can read, write, speak and understand the English language as spoken by the average American? While I was extracting all this information from the man as required by the application blank, I should have the blank filled out in the office, instead of at home. A case came under my notice in Pittsburgh about a year ago when a young man made application for a position as brakeman with the Baltimore & Ohio. His letter to the train master was written in a very good hand and he used very good English. The company asked him to call and fill out a formal application, as they were in need of brakemen. While I was engaged in conversation with the chief clerk, the man came in and was handed a blank to fill out. After spoiling three blanks, he finally admitted that he had no education and that his wife had written the letter.

Mr. Pratt is right in urging that all letters should be answered. To neglect to answer a letter of inquiry is as inexcusable a breach of courtesy as a failure to answer a spoken question. Railroad companies are learning that courtesy is a paying asset.

As to the question of education, that is a very important matter and a desirable quantity in an applicant for the position of fireman, but I condemn any plan which hints or suggests a course in a correspondence school before the applicant secures employment. When you do that, you either intimidate or else put a money consideration on the job. The applicant may begin on a course in order to get a job, but will shortly fall by the wayside, as ninety-five per cent. of those who have begun courses ahead of him have fallen. You can't always get eighth grade scholars to fill the position, neither can you always get the son of an employee. The father too often realizes that to stand up against the huge monsters of to-day requires a man with an iron constitution, and that his son will be broken in health before he ever gains promotion from the left-hand side of the battleship.

Why should the technical school graduate use the position as anything but a makeshift to tide him over till he finds something better? His education entitles him to something better than running an engine till he is 35 years old, when unforeseen circumstances, such as sickness, a dull season or an accident, may force him out of the employment of one railroad company only to find that he is debarred by the age limit from employment on any other.

As to not hiring a man because he is "broke," the reason for that course is not valid. Were I to choose between an experienced fireman who was "broke" and a new man that had cash, I should always choose the former, especially if he were a member in good standing with the Brotherhood of Locomotive Firemen. Such an indorsement would be a sufficient guarantee to me, not only of his ability, but of his moral character as well. You don't ask a master mechanic or a traveling engineer if he has a bank account before you hire him. Why require a money qualification for any railroad job? Many a good man goes "broke."

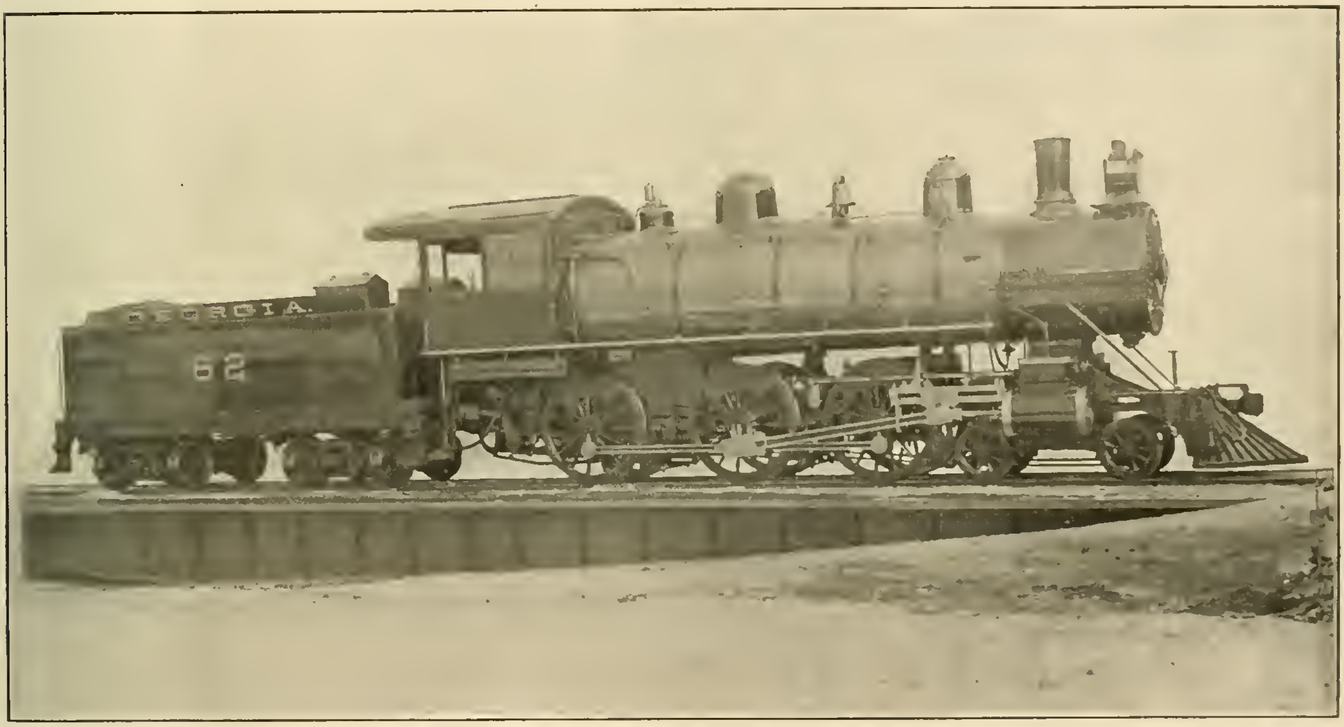
It is an easy matter to train a fireman and make a good engineer out of him if he is the right sort of material in the beginning, and it is for that purpose we have our traveling engineers and traveling firemen—to find out if the firemen are of the right sort and train them. I have found in my eighteen years' experience as an engineer and road foreman that I can accomplish more and secure better results from my firemen by personal instruction on the engine, training them in the practical way of properly operating locomotives, and advising them to read current periodicals like Railway and Locomotive Engineering for the technical knowledge necessary, rather than by depending on them to get all their knowledge out of text-books.

The practice of holding yearly examinations is a good one and you can weed out the poor timber the first year, and the indifferent material will hardly stand the second examination. But, hold your examinations on short notice. By that I mean that there should be ample time given for preparation, but that the exact date of the examination should not be announced long beforehand. The man who has been honestly studying will not be caught napping, but the man who has kept putting off the duty will not have a chance to "cram" and get through by reason of memorizing matters that he does not understand. The latter kind sometimes get through an examination with a higher percentage than their less brilliant brothers, but in the end the information thus "crammed" is never lasting and fails them when most needed.

Devise as elaborate an application blank as you will, and after the applicant has answered every question satisfactorily, it still depends on the judgment of the master mechanic in charge whether or not the road will be supplied with good firemen.

Baldwin 4-6-0 for the Georgia Railroad.

The engine here represented forms a good example of passenger 10 wheel power, and was built at the Baldwin Locomotive Works for the Georgia Railroad. The engine is simple, with balanced slide valves and ample boiler capacity. The gauge of the Georgia road is 4 ft. 9 ins.



J. S. Cook, Master Mechanic. BALDWIN TEN-WHEELER FOR GEORGIA RAILROAD. Baldwin Locomotive Works, Builders.

The cylinders are 20x26 ins., and the driving wheels are 66 ins. in diameter. The weight carried on the driving wheels is 133,540 lbs., which gives an axle load of something over 22 tons each. The main drivers are the center pair, and the butt end of the connecting rod is coupled to the main crank pin outside the side rods. Both main and side rods are of I-section and the Laird type of crosshead is used. The eccentrics are carried on the main driving axle and the length of the eccentric rods place the link near to the forward driving axle. A transmission bar conveys the motion of the link block back to the lower end of the rocker which is seen between main and forward drivers. The valve motion is, of course, indirect.

The boiler is 66 ins. in diameter in the first course. The gusset sheet is the second, and the third, or dome course, measures about 72 ins. in diameter. The fire box is 100 ins. long by 42 ins. wide, with a grate area of 35 sq. ft. The heating surface derived from the tubes is 2,656 sq. ft., from the fire box 195 sq. ft., and from the fire brick arch tubes 18½ sq. ft., making a total of 2,869½ sq. ft. The back sheet slopes in toward the top, but the crown sheet, though slightly arched, is level, and there is a good steam space between it and the roof sheet. The tubes number in all 340 and they are each 15 ft. long; they are made of iron and are No. 12 gauge in thickness.

The tank has a capacity of 6,000 U. S. gallons, and the tender frame is made of structural steel, and is carried on deep arch-bar trucks. The engine and tender together weigh about 280,000 lbs., and have a total wheel base of 56 ft. 7¾ ins. The engine is symmetrical in design and has the appearance of being a very serviceable machine. Some few of the principal dimensions here follow:

Boiler—Type, wagon top; thickness of sheets, 11-16 and ¾ ins.; working pressure, 200 lbs.; staying, radial.

Fire Box—Depth, front, 79¾ ins.; back, 69 ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ½ in.; tube, ½ in.; water space, front, 4 ins.; sides, 3 ins.; back, 3 ins.

Driving Wheels—Diameter, 66 ins.; journals, 9 x 12 ins.

Engine Truck Wheels—(Front) Diameter, 30 ins.; journals, 6 x 10 ins.

Wheel Base—Rigid, 14 ft. 10 ins.; total engine, 25 ft. 10 ins.

Weight—On Driving Wheels, 133,540 lbs.; on truck, front, 31,625 lbs.; total engine, 165,165 lbs.

Tank—Capacity, 6,000 gallons.

Tender—Wheels, diameter, 30 ins.; journals, 5 x 9 ins.

Methyl Alcohol for Locomotive Fuel.

There was a discussion one day last month in the House of Representatives on the manufacture and use of alcohol for industrial purposes, which brought out rather startling information, which is highly important if true. There was a report submitted which said that methylated alcohol can be made for about $4 a ton, even in Germany, where so-called refuse is more closely worked up than in this country, and that it makes the finest sort of fuel. It is so cheap that its use for generating steam, even on locomotives, is held to be cheaper than the use of coal.

This liquid fuel certainly ought to come into competition with all sorts of solid fuels, for under proper combustion facilities it would be clean, cheap and safe. Methylated alcohol has a specific gravity of .81. As there are 8⅓ pounds of water to the gallon, the weight of alcohol is 6.75 pounds per gallon. There are very nearly 300 gallons of alcohol to the short ton of 2,000 pounds, so at the rate of $4.00 a ton this fuel costs about one and one-third cents a gallon. As gasoline costs users from ten to twenty cents a gallon, methylated alcohol, which has nearly as much heat power, ought to prove a dangerous competitor for the wicked smelling petroleum compound.

Methylated alcohol is wood spirits and was originally made by the destructive distillation of wood and consists chemically of two equivalents of carbon and three of hydrogen. It can be made from any substance containing its constituent elements, but it is now extracted principally from the refuse of sugar factories, from corn stalks and other farm refuse, and the weeds that grow so profusely in swamps are regarded as good raw material for the manufacture of methylated alcohol. The thermal value of wood alcohol is about 15,000 heat units per pound, as compared with 14,500 for the best quality of coal.

As originally produced, wood alcohol was made almost entirely from the distillation of hard wood, but the process has been greatly extended lately and special apparatus introduced to shorten the processes and to prevent waste. In the old plants about half a cord of dried hard wood was placed in a closed retort of cast iron or sheet steel and fire applied. The process takes about 12 or 14 hours when nothing is left in the retort except charcoal and from seven to eight gallons of liquid product have passed through the still with some non-condensible gas. The liquid consists largely of acetic acid, methyl alcohol, and tarry matter. These are separated by subsequent operations. The process described is the foundation on which was built up the modern elaborate process of extracting alcohol from all hydrocarbon substances.

New Grand Trunk Roundhouse.

The Grand Trunk Railway of Canada is engaged in the work of erecting a large roundhouse at New Toronto, a suburb of the city of that name. It is to have a capacity of thirty-seven stalls. The building is to be made of concrete reinforced with metal, and the estimated cost is about $50,000. The building is believed to be one which is practically indestructible except by the ravages of time.

The roundhouse and the freight yards which the company are constructing at this point will be lighted by electricity. In connection with the roundhouse will be a machine and repair shop. This building is 157x50 ft., and, as a "back shop," it affords accommodation for two engines at a time. Motive power offices will also be placed here, which will accommodate the locomotive foreman and his staff and the stores department. The building for this purpose is 68x20 ft. Modern coal chutes will be erected and an up-to-date ash handling system will be installed, and sanding and watering facilities will be provided.

The freight yards will contain about 25 miles of track and with the buildings necessary in freight handling will all form the nucleus of a prosperous railroad village which the company will expand by building houses for its employees.

Juggling With Railway Rates.

For years various channels of publicity have been carrying and circulating the information that railroad companies were imposing grievous injustice upon the people by granting special favors to big shippers by rebates of freight charges, special privileges for private car lines, private track allowances, switching allowances, etc., and public sentiment was so aroused that vigorous claims for justice and fair dealing were demanded. There was no complaint that freight rates are too high or unfair in any manner except when they were reduced to benefit favored persons when the injustice was far-reaching. It is a given commentary on the manner that Congress distorts the sentiments and ignores the wishes of the people that the demands for fair dealing by the few offending railroads has brought forth a measure giving the Interstate Commerce Commission power to regulate railroad rates without any remedy for the admitted evils of discrimination.

Nearly all American railroad companies treat the public and shippers fairly the exceptions being a few big corporations strong enough to defy the laws and railway rates are the lowest to be found in the world. Yet because there are a few transgressors for whom special penalties ought to have been provided, the legislators who misrepresent the people in Congress are preparing to pass laws that will inflict injustice upon every company that moves freight cars.

The directors of the Pennsylvania Railroad Co. and of the Pennsylvania Co. have decided to order eight new locomotives from outside builders. The order includes two Cole balanced compound engines, two of the prairie type, two consolidations and two Vauclain balanced compound locomotives.

Son—Papa, what is a philosopher?

Father—A philosopher, my boy, is a man who will pay his car fare, forgetting that he has a transfer in his pocket, and not get mad when he discovers it afterwards.—*Puck.*

Fracturing Anti-Friction Metal.

An interesting feature in the line of anti-friction metals, and something which is entirely new, is shown in the half-tone reproduction below.

The particular point of interest lies in the peculiarity of crystalization and forms the chief basis of claims of superiority which are made by its producers. The photograph represents a piece of metal which has been nicked on one side and after being placed in a vise, has been broken off by a sharp blow from a heavy hammer. This operation reveals a fibrous, stringy mass; the crystals, it will be seen, extend perpendicular to the chilling surfaces. The alloy is of tin and aluminum base and a remarkable characteristic is that these fibers always radiate from the chilling surfaces, regardless of the number of times reheated, thereby presenting the ends and not the sides of the fiber to the sliding friction surface.

It is well known that in the case of wood and of wrought iron the surface exposing the ends of the fiber will stand a greater amount of crushing weight and wear, than the sides of the material. It was for this same principle in an alloy that the metallurgist who produced this

FRACTURE OF ANTI FRICTION METAL.

worked. His efforts have extended over a period of twenty years and the result is claimed to be all that could be wished.

To prove the soundness of the theory of resistance to wear the composition was given many severe tests which were, in all instances, gratifying. Its great toughness and malleability combined, it is claimed, permits it to withstand the most severe shocks without becoming brittle or what is ordinarily called "crystallized."

A close examination of the fractured metal shows it to be of so fine and smooth a texture, with no granular matter intervening, that it may be said to be a truly chemical compound.

Users of anti-friction metals always experienced difficulty in remelting and using them over, owing to the grosser metals—those which melt at the lowest point—volatilizing and escaping which leaves the composition harder with each pouring. The producers of this metal say they have entirely overcome this and that by a perfect combination of metals they have secured an alloy which, it might be said, has produced—not a new composition—but an entirely new metal in itself that will admit of remelting an indefinite number of times without becoming hard or harsh or losing any of its original properties.

The characteristics of this metal would make it particularly desirable for use in linings of driving box and engine truck brasses, eccentric straps, crosshead gibs, steam and gas engine bearings, ships' bearings, wood working, and all kinds of high speed machinery.

The Buda Foundry & Manufacturing Company, of Chicago, will place this metal on the market, together with some new bronzes and a copper-steel composition, the latter being, they say, a rediscovery of the lost art of copper hardening.

This new departure on the part of the Buda Foundry & Manufacturing Company, whose former output has been largely confined to track supplies, will in the future be made an important branch of their increasing business, though will not in any way interfere with their railroad specialties. "We were attracted to these metals," said Mr. H. K. Gilbert, secretary of The Buda Company, "by the exceptional merits which they possess. Thorough tests have convinced us that we have in them, something which will be an agreeable surprise to users of anti-friction alloys, and that they will create a great demand for themselves. We are sending out samples free to interested persons, and an examination will show them to be of unusual interest and value."

Model of a Model Railway Junction.

A novel method of instructing railway men in the meaning, functions, and operation of signals is in vogue on the Great Western Railway of England. Once or twice a week a squad of men to be instructed are taken to London and introduced to what is really a miniature railway junction, and they are there instructed in the working of signals by means of a large model showing tracks, signals, levers, etc.

The model is about twenty feet long and has a frame with 25 levers. Of these 21 are working and 4 are spare. The apparatus represents a double line junction with a storage siding and a branch running off one of the main lines. The model is in a large well-lighted room close by Paddington station in London and it has taken some years to construct. Facing point, lock, bar, crossover bed, lever frame signals are all perfectly represented, and the model works accurately and the interlocking is positive and exact, yet everything is exposed to view.

The chief of the signaling department of the G. W. R. states that it is well nigh marvelous how quickly the men learn from the model, the intricacies of the mechanism, and get a grasp of the scope of the system. The men are made to work the model, under instruction, and have to put themselves in the same position as if they were controlling a junction.

The whole scheme is very popular with the men, who can learn by constant experiment and repetition the value of every lever they handle, and of every move they make. It is more reliable than instructing a man in a signal tower, because with the model the fear of danger or delay does not hamper the learner's mind. It is also very popular with the public, as crowds of interested spectators daily beg to be allowed to watch the demonstration lessons. All this is as it should be, and we believe that signal demonstration apparatus will before long be added to the equipment of the instruction car which is now such an important institution on many of our large American roads.

Hiring Engineers.

The Buffalo, Rochester & Pittsburgh Railway people are hiring first-class locomotive engineers. Applicants are required to pass an examination to prove their knowledge of the business. Mr. W. T. Noonan, general superintendent, Rochester, N. Y., is the official who looks after the hiring of new men.

The progressive railroad manager of the present day seeks success in his motive power department by driving his engines to the limit and permitting them to remain out of service for the least possible time. During the winter months the time required for melting snow and ice from the running gear and putting the engine in shape for another run has been very materially reduced by modern methods of heating and ventilating the roundhouse. A thoroughly up-to-date example is that of the Blair Furnace roundhouse of the Pennsylvania Railroad at Altoona, Pa. Here a large steam hot blast apparatus constructed by the B. F. Sturtevant Co., of Boston, Mass., is employed to distribute heated air throughout the building, and also to force it in large quantities into the pits beneath the locomotives. The time required for cleaning and repairs is thereby reduced by 60 or 70 per cent.

A woman who was waiting for a train in Humboldt recently had a bad scare. A freight train was backing up as she stood on the platform and one of the brakeman called to the other: "Jump onto her when she comes by; run her down beyond the elevator and cut her in two and head end up to the depot." The local paper adds that the lady jumped and yelled murder as loud as she could.—*Kansas City Star.*

What's in a Name?

At Montreal the advertising manager of the Canadian Pacific is a man named Ham, and the city ticket office is in charge of a man named Egg. The two are fast friends, and if both happen to be out of town at once inquiries for Ham and Egg are frequent. By a coincidence both report to an official named Bacon, whose chief clerk is named Brown. Recently Ham and Egg were both in Bacon's office. The telephone rang and Brown answered. He caught an inquiry for the Canadian Pacific office, and said:

"This is it."

"Who's this talking?" asked the voice.

"This is Brown. Do you want Bacon?"

"No, I don't want bacon, brown or any other way. I want one of the Canadian Pacific officials."

"Well, will Ham and Egg do? They're both here."

"I don't want any of them! Central, switch that cheap hash house off this wire!"—*Seattle Post-Intelligencer.*

A Novel Danger Signal.

To guard against accidents on the well-known Levens viaduct, in Westmoreland, England, the Furness Company have erected an ingenious automatic signaling apparatus. It consists of a combined wind pressure gauge and recorder, and is connected, says *The Yorkshire Post*, with an electric arrangement by means of which bells are set ringing in distant signal cabins. These bells will continue to ring so long as the velocity of the wind on the viaduct is dangerous to passing trains, and consequently all traffic will be stopped. A mail train was blown over on this viaduct during a gale in February, 1903.

A couple of machinists in Loveland, Cal., claim to have discovered a flux which enables them to weld cast iron. They also claim that by use of their flux aluminum can be soldered as easily as tinned iron.

A decided novelty in railway passenger transportation was telephoning from a snow-bound train. During the February storms a passenger train became stalled in a series of snow drifts between Buffalo and Jamestown. As soon as the trainmen discovered that they must spend the night there a long distance telephone line was tapped, a telephone established on one of the coaches, and the passengers were able to communicate with friends in various cities.

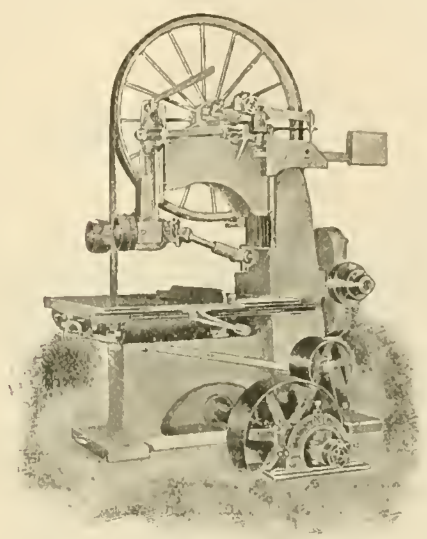
The new waterway from Rotterdam to the sea has been formed so that large seagoing vessels can ascend to the city without difficulty.

Ripping With a Band Saw.

There is hardly a woodworking shop in existence, from the smallest wheelwright shop to the largest ship yard, that does not have lumber to rip. This latter class of mills, as well as the large car shops, and other places where much ripping is done, for a long time used circular saws and these saws answered as long as no better tools could be procured.

But the band rip saw has come, and is revolutionizing lumber ripping. Its thin blade saves a tremendous waste in kerf, which if wasted amounts to a big sum when fine lumber is cut. The band rip saw is everywhere replacing the circular saw by doing the work with a greater saving, efficiency and output.

The credit for this improvement in ripping machinery is claimed by the



NO. 109—PATENT BAND RIP SAW.

J. A. Fay & Eagan Company of Cincinnati, O. They for a long time recognized the demand for a machine that was capable of answering the most exacting requirements in mills having large quantities of lumber to rip, and after the most patient and painstaking experiments, new and original inventions, a long experience, combined with a determination to make perfection their end they have finally produced a tool that is without doubt one of the best of its class.

We present to our readers the picture of their improved No. 109 New Patent Band Rip Saw, a machine that is destined to find its way wherever a tool for doing fine ripping in light or heavy lumber can be used.

This band rip saw is for doing any kind of ripping in large and heavy timbers. It will rip with facility any thickness from half an inch to 14 and 28 ins. wide between the saw blade and the fence.

For instance, say short or long timbers 10 by 10, 14 by 14, 14 by 30 ins. With such stock you can cut 2 by 8, 3 by 4, 6 by 6, 10 by 10 ins., or any other sizes wanted. Where long timbers are ripped by hand feed, this tool soon will repay its cost.

While it is adapted for heavy work, it is equally good for ripping the finest lumber into small strips, and it is here that the thin blade of the saw will be appreciated better than at any other time.

The tool presents such an array of original features and improvements that only a circular can adequately describe them; the patent straining device on the saw blade is hung solely on a knife edge balance, and this gives a continual uniformity in the strain and prolongs the life of the blade very much.

Knew the Train Quite Well.

A traveler went into a Union avenue barber shop yesterday morning to get a shine, and decided to inquire about his train. "Say," he said, addressing the negro bootblack, "what time does the Missouri Pacific leave for St. Louis this morning?"

"Yoh mean the one that makes the daylight run?" queried the negro. "Yes, that's the one," said the man. "It ah the train that connec's wif the one frum Leavenswuth, ain't it?" asked the bootblack as he brushed away. "Yes." "Runs fru Wahnsbu'gh?" "Yes." "An' Jeffahson City?" "Yes" "Ah knows the train yoh means, all right. Stan's on the secon' er thud track, doan' it?" "I think it does." "Changes ingines——. Le's see. Wha' do that train change engines?" "I don't know," came from the man. "What I want to know is its leaving time." "Ah knows jes' what yoh wants, an' Ah knows jes' 'xactly what train yoh means." "Well, when does it leave?" "Oh, yes, when do it leave? Ah's suah Ah doan' know 'bout that, boss," was the negro's reply.—*Kansas City Times.*

Only One Grand Prize to Air Compressors.

The value of the Louisiana Exposition in the promotion of commerce and manufactures is illustrated, in one instance, by the fact that the two large compressors in Machinery Hall, which furnished all compressed air used at the Exposition, were both sold before the closing day. The larger one goes to Shaft No. 3, of the Doe Run Lead Co., at Central, Mo., and the smaller one to the City of Columbia, Mo., for the air lift water supply system. The first machine received the only grand prize awarded at the Exposition to air compressors. It has a capacity of 1,300 cubic feet of free air when running at 125 revolutions, and is distinguished by several novel features, the most important of which is the Cincinnati valve gear, the opening and closing of the admission and the closing of the exhaust being controlled mechanically, while the opening of the exhaust is determined by poppet valves, thus permitting high speed without throttling of the air and wear and rattling of the valves. The smaller machine is fitted with mechanically moved inlet valves, and is rated at a displacement of 500 cubic feet per minute. Its good workmanship and perfect operation at the Exposition so much impressed the officials of the city of Columbia that they countermanded an order on another manufacturer in order to take this compressor. Both machines were built by the Laidlaw-Dunn-Gordon Co., of 114 Liberty street, New York City.

The experiments with the balanced compound locomotives on the Pennsylvania testing plant have led the management of that company to order two Vauclain balanced compounds from the Baldwin Locomotive Works and two Cole balanced compounds from the American Locomotive Company. The Pennsylvania Railroad Company have had considerable experience with compound locomotives that was not entirely satisfactory, and it is highly creditable to the management that they are ready to try again.

The Pressed Steel Car report for the year ended December 31 has been issued. President Hoffstot says the abnormal conditions of the car building business in 1904, there having been no such depression in the company's business since 1893, accounted for the gross sales last year being only $4,498,268, with a loss on the year's transactions of $707,110.

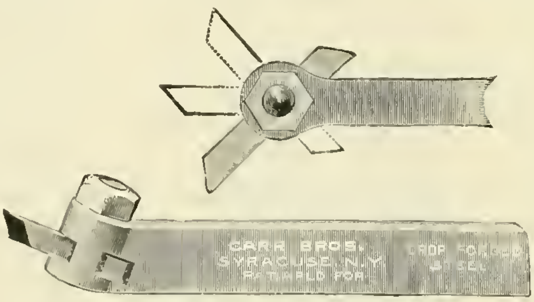
The Budd Foundry & Manufacturing Company have recently increased the facilities of their eastern branch, which is located in the Havemeyer building, New York City. A complete stock of their track specialties will be kept on hand for the convenience of buyers. Mr. Robert Spencer has been appointed eastern sales manager and will have charge of their office.

For the first time in maritime history the task of towing a laden barge fifteen thousand miles, from New York to the California coast, was begun last month. The Standard Oil tank steamship Atlas, as well as the barge which she tows, carries a cargo of oil. The cargo of the Atlas will be used as fuel on the voyage. It is expected that the trip will occupy from seventy to eighty days. It is the intention to avoid doubling Cape Horn by going through the straits of Magellan. The success met with in towing barges from the gulf to New York and Philadelphia led to the consideration of the project. If successful the service will be extended to European points.

The city of Chicago has been wise enough to take care of its own interests in the matter of its 30 miles of new freight tunnels. It is to receive 5 per cent. of the gross earnings the first ten years, 8 per cent. the second ten and 12 per cent. thereafter during the life of the franchise.

Carr Brothers' Boring Tool.

The accompanying cut shows a new boring tool brought out by Carr Brothers, of Syracuse.



It is designed for tool makers or for light work. When they want a neat and handy tool taking in four sizes of tools, 1/2, 3/8, 5/16 and 1/4 inch, made of Stubs steel in block or holder, being dovetailed on four sides and by turning the block any side can be brought to the clamp. It is made of drop forged steel, case hardened, and is finely finished.

It took a great many years of enjoyment of benefits to the people that came from mechanical inventions to make what used to be known as learned classes to cease looking disdainfully upon everything of a mechanical character. Dean Swift spoke of Isaac Newton as "that fellow over the way, a glass grinder and a maker of spectacles."

The invention of bells is attributed to the Egyptians, who are credited with having made use of such percussion instruments to announce the sacred creeds of Osiris.

It is said that the most costly leather in the world is known to the trade as piano leather. The secret of tanning this leather is known only to a family of tanners in Germany, though the skins from which it is tanned come almost entirely from America.

Otto Gas Engine Company's Water Purifying Plant.

The annexed engraving has been made from a photograph of a water softening plant which has just been erected for the L. S. & M. S. Railway for joint use with the L. E. & W. Railway, at Fremont, Ohio. The plant has an easy capacity of 500,000 gallons per day, and the situation is an ideal one to show the benefit of this treatment, both on account of the character of the water and the amount used by the two roads.

Very little attention is required in keeping a plant of this kind in running order; in fact, a small portion of the time of the pumper will be all the labor required.

A report which we have seen from the chemist of the Lake Shore & Michigan Southern, shows that in the course of a recorded test of the Otto water softening plant reduced to solids in the water from 77.72 to 12.54 grains to the gallon.

OTTO WATER PURIFYING PLANT AT FREMONT, O.

Captain Roosevelt Navigated Western Rivers.

One of the pioneer navigators of the Ohio and Mississippi rivers was Nicholas J. Roosevelt, grandfather of President Roosevelt. Early in the nineteenth century Captain Roosevelt was associated with John Stevens and Robert R. Livingston in experimental boat building about New York harbor. While so engaged he invented the vertical wheel propeller, which did so much to make steamboating practicable.

Soon after Robert Fulton began operating steamboats on the Hudson, Captain Roosevelt conceived the idea of using steamboats on the western rivers. A good deal of doubt was expressed as to the practicability of the undertaking, but Captain Roosevelt was enthusiastic, and along about 1810 made a personal survey of the Ohio and Lower Mississippi to determine its feasibility beyond all peradventure. The result of his survey was entirely to his satisfaction, and, returning to Pittsburgh, he began the construction of a steamboat from plans furnished him by Fulton and Livingstone. In the spring of 1811 the vessel was launched, and, accompanied by his wife, who had the true pioneer spirit and refused to be left behind, the President's grandfather began his voyage down the Ohio. He entered the Mississippi during the throes of the earthquake which devastated so much of southeastern Missouri, but weathered the tumult successfully and continued his trip to New Orleans, where he arrived a short time after, the first man to build a steamboat west of the Alleghanies and the first to navigate one on western waters. It is an interesting historical fact in itself and doubly interesting for existing reasons.

Consulting the Oracle.

The most celebrated of all the oracles of ancient Greece was that of Apollo at Delphi. The original name of this city was Pytho, and the old name of the place is generally used as an adjective to describe Apollo in connection with this oracle and its revelations. The power of prophesy was exercised to a great extent in the oracle at Delphi. The ancients were, however, not inclined to undertake anything which they considered to be important in public or private life without first consulting the oracle.

The noble families of Delphi had the exclusive superintendence of the oracle. Thus they had great influence upon its utterances; in fact, it is believed that they dictated the revelations which were supposed to be made to the anxious inquirers, who came to the temple. The utterances of the god were often ambiguous and had to be interpreted by the priests, and for this and for obtaining the revelation they were well paid by the seekers after truth. Those seekers had, indeed, small chance of getting the truth, for the priests were as ignorant as the common people, but were much more cunning.

When one looks back in thought to those early days, one appreciates to some extent the vast difference that exists between the certain and definite knowledge which to-day we call Science, and those dark and uncertain answers that were given to men as the truth, at the shrine of the Pythian Apollo.

The oracle with all its deceit and humbug has passed away and to-day recorded facts, the discoveries and the honest work of others are the things we have to deal with. These are most easily got at through medium of the printed page and we invite our readers to look over a selection we have made.

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and children see it.

"Twentieth Century Locomotives," Angus Sinclair Co., deals comprehensively with the design, construction, repairing and operating of locomotives and railway machinery. First principles are explained. Steam and motive power is dealt with; workshop operations described, valve motion, care and management of locomotive boilers, operating locomotives, road repairs to engines, blows, pounds in simple and compound engines; how to calculate power, train resistance, resistances on grades, etc. Shop tools explained. Shop receipts, definitions of technical terms, tables, etc. Descriptions and dimensions of the various types of standard locomotives. The book is well and clearly illustrated and is thoroughly up to date in all particulars, fully indexed. Just off the press. Price, $3.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. The price of it is 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. The price is 75 cents.

The 1904 Air Brake Catechism. Conger. Convenient size, 202 pages, well illustrated. Up to date information concerning the whole air brake problem, in question and answer form. Instructs on the operation of the Westinghouse and the New York Air Brakes, and has a list of examination questions for enginemen and trainmen. Bound only in cloth. Price, $1.00.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion, it is easily understood by every intelligent fireman. The price is 50 cents.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable, and, best of all, they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Standard Train Rules." This is the code of train rules prepared by the American Railway Association for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotive, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

Railway and Locomotive Engineering. Bound volumes. $3.00.

The Blow-Off Valves and Swinging Joints, made by the L. J. Bordo Company, of Philadelphia, are catalogued, illustrated and described in a neat little catalogue which has just come to hand. The locomotive blow-off cocks are made with drain-plug in the bottom to prevent freezing. The plug can be made of all brass or cased with wearing metal which will not stick or jamb. The company makes swing-joint and pipe attachment which may be used between engine and tender instead of flexible rubber hose. Locomotive gauge cocks are made either with wheel or lever, as desired. The catalogue gives sizes and lists of parts of all the company's products, and it is printed in convenient pocket size. If you are in need of information such as this little booklet contains, drop the company a post card and they will be happy to send you one or more of these little books.

We have received the Union Switch and Signal Company's catalogue, Section No. 11, which deals with electric locks, electric slots, hand releases and time locks. The catalogue is uniform with the former publications of this company both in size and style. It is well illustrated and all parts are named and numbered for ordering. We have also received Section No. 3, which deals with Mechanical Locking and Operating Devices. Bulletin No. 23 is a plain statement of the construction and operation of the latest type of electric train staff. The company has recently greatly improved the electric staff machine and this bulletin is clearly illustrated. A perusal of its contents will give the reader a good idea of the advantages of the train staff system on single-track railway operation. Write to the company's head office, in Swissvale, Pa., if you would like one or other of these catalogues or the bulletin.

The Norton Ball-Bearing Jack and the "Sure Drop" track jacks, manufactured by A. O. Norton, of Boston, Mass., are duly set forth in a neat little illustrated catalogue which has recently come into the office. The Norton jacks are thoroughly well adapted for railway service, and the Norton ball-bearing ratchet screw jack is a very well made and useful tool. This catalogue contains not only information concerning the height, size, capacity, rise, etc., but the price of each kind of railroad jack is given. Write to Mr. Norton, 286 Congress street, Boston, if you would like to have a copy of the pocket-size catalogue of these jacks.

City Electrician Edison, of Chicago, is making a test of automobiles for carrying his inspectors and electrical repair men. Hitherto these men have had to depend upon street cars for transportation to the points where their services were required, and it caused great waste of time. The automobiles take the men direct to the point where their services are needed, and when one job is finished move them promptly to the next place. The new system was begun when the city was suffering from a snow blockade and it is said to be working very well.

A Holy Railway.

One naturally associates pilgrimages with long weary journeys on foot where the wayfarer endures patiently the heat of summer and the cold of winter as a soul purifying ordeal. Railways and steam transportation of other kinds have changed all this. We now hear of crowded steamers carrying pilgrims to the port nearest Mecca, and now we have on the American continent a railway—a "holy highway." This is a little line, twenty-one miles long, from Quebec to Ste. Anne de Beaupré. It is sacred because it claims to run "especially for the accommodation of pilgrims," and above all, because at its opening, a few years since, it was formally blessed with all its belongings by Cardinal Taschereau. Every Sunday the trains are crowded with devotees in search of the blessing of the good St. Anne, who is credited with the miraculous power of healing, and on July 26, St. Anne's Day, the road cannot accommodate the enormous crowds which flock to her shrine.

Think of riding on a holy railroad! But those who have traveled on it know that they must not expect the comforts of Paradise. It may be called "holy," but it seems to be run, none the less, with an eye to dividends. The charges are high and the service poor.

The Hayden & Derby Manufacturing Company, of 85 Liberty street, New York, have recently issued a neatly printed catalogue dealing with Metropolitan injectors. The catalogue is intended for reference and is made pocket size for the purpose of being carried conveniently by the user, as it not only contains descriptions and illustrations of the injectors, but it gives valuable hints on how to select the proper kind and size of injector for certain kinds of work and how to properly estimate conditions in making the selection. This company makes the Metropolitan automatic injectors, the Metropolitan "1898" injectors, Metropolitan double-tube injectors, H-D Ejectors and Jet Apparatus. The company will be happy to send a copy of the pocket catalogue to anyone who will apply to them for one.

The Pratt & Whitney Company, of Hartford, Conn., have sent out a catalogue on turret lathes which is a very artistic production. It is beautifully illustrated with half-tones and line cuts showing the various patterns of turret lathes made by the company. The letter press, which is printed in tinted ink, gives information as to the construction and operation of the lathes. The turret mechanism is explained in detail, and the various turners and cutters which are used with the lathes. The tools and tool holders, chucks, etc., are all enumerated and described. At the end of the catalogue there are line cuts with dimensions figured, together with the position and sizes of the countershaft and pulleys required. The Pratt & Whitney Company will be pleased to send a copy of this catalogue to anyone who writes to them for one.

"Carey's Special," is the attractive title of a catalogue got out by the Philip Carey Manufacturing Company, of Cincinnati, Ohio. This company makes sectional locomotive boiler lagging, 85 per cent. magnesia, and in addition to a short explanation of the composition and qualities of the lagging, there are a number of excellent half-tones of locomotives, about the same size as those which appear in RAILWAY AND LOCOMOTIVE ENGINEERING. A number of the leading roads whose engines are covered with this special boiler lagging are represented by the half-tones of which we speak. The B. & O., the Pennsylvania, the Louisville & Nashville, the C., M. & St. P., the Wabash, the C., N. O. & T. P., the Big Four, the Chicago & Alton, the Santa Fe, and many others are to be seen on the pages of the catalogue. The Carey Company will be happy to send what we may call their souvenir cataolgue to anyone who will apply to them for a copy.

The Record of Recent Construction, No. 49, which has just come from the Baldwin Locomotive Works, is printed uniform with other similar publications got out by that well-known firm. It is devoted to balanced compound engines and among the illustrations and descriptions of this class of locomotive is to be found the balanced ten-wheel engine for the N. Y., N. H. & H., a similar engine for the Chicago Short Line Railway, the Atlantic type for the Santa Fe, and the Atlantic type engine, 2700, for the C., B. & Q. The pamphlet contains an article setting forth the advantages of the balanced type, and it gives details of the cylinders, piston valves, valve bushings, diagram of the counterbalance, an elevation and plan of the running gear. The different forms of crank axles are illustrated and explained, and the method of balancing the cranks where such is desired is given. The pamphlet is a very interesting contribution to the literature of the subject.

A very neat pocket-size pamphlet has just been got out by the Hancock Inspirator Company, of Liberty street, New York. The little book contains an illustrated description of the company's factory, and a history of the Hancock inspirator itself. There are some general suggestions and information, and two or three paragraphs on "How to Select the Proper Size of Inspirator." Then follows a number of particular descriptions with half-tone illustrations of the various types of inspirators made by this company, with sizes of pipe connections and capacity of each size. The company will be pleased to send a copy of this interesting little catalogue to anyone who is interested enough to write to them for one.

Woman Mistaken for a Whisky Smuggler.

There appears to be a new and novel danger for women traveling in the Indian Territory. One who had gone through an exciting experience thus related her story to a reporter of the Kansas City *Journal:*

"When I got on the train part of it was in Arkansas and the front end in the territory, and the depot was on the dividing line. A negro came in wagging a heavy looking suit case much the same size and color as mine, and he placed it under a seat near me and went to the rear of the chair car himself and occupied another cushion.

"Hardly had the train crossed into Indian territory before four very rough looking men, all of whom looked like they might be train robbers, began walking up and down the aisle of the car, all the time watching my suit case. I wondered what in the world could be the matter, and finally one of them approached, and, after looking closely at the case, said to the others that mine was the suit case they were looking for, and with that he started to open it. I stuck him with a hat pin and told him he would get in serious trouble if he did not let me alone. They continued to torment me about my grip until I was almost humiliated to death, when finally one of them spied the negro's case under a seat and opened it at once. In it were several bottles of whisky which the negro was taking to the territory to sell. The handcuffs were on his wrists in less time than it takes to tell it, and then I realized what was the matter. Those marshals thought I was 'bootlegging' whisky."

Steam Turbines is the title of a very handsome, standard size catalogue, issued by the Westinghouse Machine Company, of 10 Bridge street, New York. The catalogue takes the reader from the earliest use of steam up to its modern development in the form of the Westinghouse-Parsons Steam Turbine. There is a section of one of these turbines shown by which all the working parts may be studied and the action of the steam upon the rapidly revolving blades is made plain. The economy of space which the use of a steam turbine secures is graphically represented, both as regards floor space and vertical height by a very neat pair of diagrams; and efficiency tests for a 400 k.w. turbine, a 750 to 1,000 k.w. turbine, and a 1,250 k.w. turbine are given in tabular form. Write to the company if you desire a copy of this catalogue or desire any further information concerning this well known make of steam turbines.

Increasing Height of Sleeping Cars.

Sleeping and dining cars have been increasing in weight at the rate of 5,000 pounds per year for the last seven years, and the maximum weight is now 135,000 pounds. Only a few years ago the average coach weighed 50,000 pounds. Now a 70-foot coach body without seats or fixtures weighs 60,000 pounds, the seats and trimmings 10,000 pounds, and the two six-wheel trucks 40,000 pounds, making in all 110,000 pounds, or considerably more than twice the weight of the coach of 1880.

From Cairo to Luxor by Railway.

If a passenger in Egypt decides to travel up the famous Nile by rail he can cover the distance between Cairo and Luxor in 15 hours, and he will have made a journey of 420 miles. The train leaves Cairo at 6 P. M. and arrives at the city of temples at 9 A. M. the following morning.

The sleeping cars, says Mr. W. E. Curtis, the well-known press correspondent, are of the compartment type which are used in Europe, and the unpleasant part of spending a night on the road is the difficulty of getting sufficient ventilation. If a passenger should leave his window open at night he would find himself buried under a heap of sand in the morning.

The locomotives have their machinery "boxed in" wherever possible to prevent sand getting at the working parts. These engines have, on the desert part of the line on the way to Khartum, to haul their own water, as an ordinary tankful would soon be used up on that long, dry, hot, sandy trip. Some remarkable faith cures are said to have been effected by the engines, for among the natives these wonderful machines are thought to possess occult powers, and the halt and the lame and the blind hasten to the station in order to touch the sides of the steel monster —and recover.

From Luxor to Assouan is a distance of 130 miles. At this point is the famous dam across the Nile which retains enough water to thoroughly irrigate the Lower Nile lands in the intense drought of summer. The trip takes 10 hours and is over a narrow gauge line. From Assouan to Khartum is a distance of 880 miles. This line, which passes through desert country, was originally built in part at least 20 years ago. It was destroyed by the Dervishes during the rebellion led by El Mahdi, and during the conquest of the Sudan was rebuilt by Lord Kitchener at the rate of one mile a day until all had been restored.

Couplers That Will Couple.

The Supreme Court of the United States recently rendered a decision in the case of Johnson vs. the Southern Pacific, which will be interesting to all railroad men. The case arose out of an accident by which Johnson lost an arm when coupling a railroad dining car to a locomotive in Utah.

The decision, which was given by Chief Justice Fuller, amounts to a ruling that the safety appliance law will have to be faithfully obeyed, not only in the letter, but in the spirit. Railway companies will hereafter have to use couplers which will couple with other couplers, no matter of what type either may be, and, according to the Supreme Court, it will be no defense for a railroad company to plead that they had complied with the law by simply putting on a coupler which, unfortunately, would not work with the other fellow's coupler. The decision is based on such obvious common sense that it is a wonder that the case had to go through the lower courts all the way up to the highest tribunal in the land to be settled as it has been. The court practically says: "If your coupler will not couple with other couplers you have not applied a coupler within the meaning of the safety appliance law."

The court also held that locomotives as well as cars must have automatic couplers which will couple. Also that a car engaged in interstate commerce is as much subject to the safety appliance law when standing on a siding as when being hauled over the road, and dining cars, even though empty, must have couplers that will couple.

University Degrees for Railway Men.

The University of London has, under a new scheme, lately put into operation, created a special subject of instruction which has been called "Transport." This department of study is what we might broadly call the science of railroad transportation.

For some years past several of the leading English railways centering in the metropolis have paid the requisite fees in order that certain of their employees might attend lectures at the London School of Economics. The experiment proved highly satisfactory. Promising young men were selected and after they had attended the lectures and had received all the instruction given they returned to their duties and were found by the railway companies to be of increased value to them.

The London and North Western, the Great Western, the Great Northern, the North Eastern and the London and South Western Railways have now taken the project up warmly. They have arranged to make a grant of about $4,500 per annum for three years to establish under the auspices of the University of London a course of lectures on railway transport. The companies have the right under the new arrangement to send a certain number of their employees to the lectures, without charge. At the end of the course any student may proceed to take the degree of Bachelor of Science (B.Sc.) practically on his railway knowledge.

This is certainly a novel and interesting experiment and there is no doubt that a very high grade of scientific knowledge is required of those who handle transportation matters on our large railways, and whether or not such knowledge is indicated by a university degree or not it still has to be possessed by the successful railroad transportation officer. The effort of the six important English railways in conjunction with the University of London is to systematize instruction and concentrate study and so teach the art in the light of the actual performance and experience of those who have become past masters of the subject.

Steam Turbine Plant in Klondike.

The Westinghouse Companies have just entered an order for the equipment of a power house for the electrical operation of gold-dredging boats on the Alaskan rivers. The plan is an entirely new one and involves many interesting features.

A number of Detroit capitalists recently formed the Canadian Klondike Mining Company. A visit was made to the works of the Westinghouse interests, at East Pittsburgh, to ascertain if electrical machinery could be used in the gold mining plant. After considering various plans, it was decided to install a 400 kilowatt turbo-generator in the power house, to be driven by a 600 h.p. Westinghouse-Parsons steam turbine. The dredge boats are being built by the Marion Steam Shovel Company, of Marion, Ohio. On these boats will be installed induction motors, aggregating a total of about 500 h.p., and varying in size from 7½ to 100 h.p.

The fact that these people are willing to install a plant of this nature in such a distant country, far from the manufactory and possible repairs, shows the confidence engineers place in this type of unit.

The power house will be located at

Dawson City, and the dredges will operate on the Yukon river and its tributaries. Lines for transmitting power will be strung from the station to the boats, wherever they may be working. Electrical machinery is used very extensively in mining operations, but this plant will be watched with considerable interest, owing to the remoteness of the country and the new field which will be opened.

Many substances in passing from a liquid to a solid state increase in bulk, ice and type metal being the best known example. Solid lava floats on liquid lava. Solid glass floats on molten glass, and solid iron on molten iron. It is true that a piece of iron may be cold that its density exceeds that of molten iron and it sinks. But after being heated and expanded it will rise again to the surface long before the fusing temperature is reached.

Popularity of Idleness.

Indeed, the fact is, that there are idle poor and idle rich; and there are busy poor and busy rich, says Ruskin in one of his lectures. Many a beggar is as lazy as if he had ten thousand a year; and many a man of large fortune is busier than his errand-boy, and never would think of stopping in the street to play marbles. So that, in a large view, the distinction between workers and idlers, as between knaves and honest men, runs through the very heart and innermost economies of men of all ranks and in all positions. There is a working class—strong and happy—among both rich and poor; there is an idle class—weak, wicked and miserable—among both rich and poor; and the worst of the misunderstandings arising between the two orders come of the unlucky fact that the wise of one class habitually contemplate the foolish of the other. If the busy rich people watched and rebuked the idle rich people, all would be right; and if the busy poor people watched and rebuked the idle poor people, all would be right. But each class has a tendency to look for the faults of the other. A hard working man of property is particularly offended by an idle beggar; but an orderly, but poor, workman is naturally intolerant of the licentious luxury of the rich. And what is severe judgment in the minds of the just men of either class, becomes fierce enmity in the unjust—but among the unjust only. None but the dissolute among the poor look upon the rich as their natural enemies, or desire to pillage their houses and divide their property. None but the dissolute among the rich speak in opprobrious terms of the vices and follies of the poor.

Boiler Design.

"We recommend that the lowest visible part of the water glass and lowest gauge cock be not less than 3 ins. above the highest point of crown sheet, for curved and flat crown sheets, and that water glass and gauge be as near verticle center line of boiler as they can conveniently be located without having gauge cocks out of reach of engineer. We recommend 8 ins. exposed length of water glass and three gauge cocks with verticle spacing 3 in. centers."

These are practically the opening words of the report of the committee on boiler design presented to the Master Mechanics' Association at the convention held in Saratoga last June. The reason for recommending that the glass and gauge cocks be as nearly as possible in the vertical center line of the boiler is that when as close to that position as possible, they are least affected by the roll of the boiler when the engine is rounding a curve. In other words the elevation of the outer rail on a curve when it tilts the boiler to one side or the other, would give the best average water level indication, if the glass was actually on the vertical center line of the boiler, and the nearer this condition is approached, the better.

The recommendation that the minimum depth of water on the highest point of the crown sheet, when the engine is standing level, be 3 inches, gives a working margin for the side roll and the longitudinal up and down movement, sometimes called the galloping motion of the boiler when the engine is running on spongy track or in going over springy culverts, etc.

The report goes on to state that ⅜ in. per foot slope of crown sheet represents very general practice, and that this slope has proved satisfactory. The principal reasons for this, as for the other recommendations of the committee are based on answers to questions sent out by the committee to all the roads represented in the Master Mechanics' Association. The crown sheet is sloped from the flue sheet toward the back for the following reasons: On flat top fire boxes it often happens that in going down grade, or by reason of surging water, or on account of the elevation of the outer rail on a curve, one of the rear corners of the crown sheet becomes exposed, causing damage to sheet and staybolts. A sloped sheet will, in case of low water, expose less of the sheet than a level one would expose. It will give more total water space above the crown sheet and yet permit more flues to be used, and there is less liability of sediment lodging on crown sheet, and it brings the back end of the sheet where the fire is less fierce, closer to the source of heat.

The committee reports that the use of an automatic low water detector seems not to be a desirable attachment for locomotive boilers, because in summing up the answers received as to this question the majority do not favor their use. The principal objections are that such detectors seldom come into play, and when most needed they cannot be relied upon on account of being out of order. They also tend to give a feeling of false security to the engine crew, which engenders carelessness, and even though such devices could always be kept in perfect working order laxity of the crew would be the probable result of depending upon them.

Knew the Crowd.

A street preacher in a west of Scotland town called a policeman who was passing and complained about being annoyed by a certain section of the audience, and asked him to remove the objectionable ones.

"Weel, ye see," replied the cautious officer, "it would be a hard job for me tae spot them; but I'll tell ye what I'd dae if I were you."

"What would you do?" eagerly inquired the preacher.

"Just gae round wi' the hat!"—*Ram's Horn.*

The Danger of Living.

Between the multitude of microbes that are said to be assailing health and life under all kinds of dangerous guises, it is surprising that any member of the human race ever reaches an age of maturity. The danger signals sent out by sanitary boards, health authorities and disease experts, nervous persons are liable to be frightened into premature graves.

Drink water and get typhoid fever. Drink milk and get tuberculosis. Drink whisky and get the jim-jams. Eat soup and get Bright's disease. Eat meat and encourage apoplexy. Eat oysters and acquire toxaemia. Eat vegetables and weaken the system. Eat dessert and take to paresis. Smoke cigarettes and die early. Smoke cigars and get catarrh. Drink coffee and obtain nervous prostration. Drink wine and get the gout. In order to be entirely healthy one must eat nothing, drink nothing, smoke nothing, and even before breathing one should make sure that the air has been properly sterilized.

Our difficulties are our opportunities.—*Robert Arkwright.*

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

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Fishing Up Engines.

When the flood of 1903 swept down the Kaw river and inundated Kansas City, the Union Pacific lost four locomotives and seventeen freight cars in being prepared to breathe out fire and smoke as of yore. The locomotive fishing tackle used to land them consists of huge cranes which are run out on the Missouri Pacific bridge near and the cranes proceed to pull them out of the hole. As soon as an engine, muddy and dripping, comes above the surface of the water, a big barge is floated under it and the engine lowered

UNION PACIFIC RAILROAD SCENERY. THE KIND OF TERRITORY TRAVERSED BY THE BIG SYSTEM—PALISADES OF GREEN RIVER, WYOMING.

the river, owing to the destruction of their bridge by the flood.

The work of recovery has been in progress for some time and a number of cars have been brought up and three of the engines which have been under water are now on terra firma, and are Armstrong and these act as the fishermen's "rods," while heavy cables form the "line." The "reels" are the big crane drums, worked by steam. Instead of attaching bait sufficient to attract the aquatic iron horse, divers fasten the cable hooks to the engines onto it. The barge carrying the engine right side up with care, of course, is towed to the river side and the engine pulled ashore on a temporary track. They will all go through the company's shops and be none the worse for their ducking when they come out. The Kaw river fish believe that there will be more room for them when the Union Pacific have lifted the locomotives, the freight cars and the bridge members out of the way, and are assisting with advice just as human onlookers do when a railroad wreck is being cleaned up.

Sherlock Holmes as a Boiler Inspector.

An interesting account of how a Hartford Steam Boiler Inspection and Insurance Company's man detected a piece of scandalously bad and deceitful work is given in a recent issue of the *Locomotive*, which is a pamphlet issued by them as a monthly record of stationary boiler explosions with pertinent comments thereon.

It seems that in a new system of steam piping put up in a large steam plant, there were a number of flange joints used, which, as everyone knows, are bolted together. Inspection by the company's man brought out the fact that many of these bolts were too short and that only about half a nut could be screwed on to the projecting ends. The inspector called the attention of the contractor to the short bolts held each by half a nut, and a workman was sent to remedy the defect.

The workman took a supply of bolts cut to the proper length and in due time reported the work done. The Hartford boiler inspector examined the flanges after this, in order to be personally satisfied that things were as represented, and it was here that he applied the same kind of close observation and rapid mental deduction which have made the fame of the great detective. He noticed that the projecting ends of the new bolts showed the marks of a hacksaw. He reasoned that as long as a full nut could be run on the projecting end of the bolt it mattered nothing how far the bolt end came through the nut. There were the new bolts, however, apparently projecting through about two threads, and evidently sawed off at that exact length. Why all this, particularly in regard to length?

The pipes ran across the upper part of the boiler room and the air about them was very hot, and altogether it was a most uncomfortable place to work in. This also was noted by the inspector, who put two and two together, after the manner of Sherlock Holmes. He reasoned that to shorten the time he was at the flanges and to save himself personal discomfort, the workman might have made a pretence of doing the work without taking out the old bolts or putting in the new ones. Proceeding on this theory the inspector tried the bolts with the sawed ends and succeeded in taking off the nuts each with a stub about half an inch long in it. It was, therefore, evident the workman had cut off a number of stub ends of bolts and had run them into the unfilled outer portions of the nuts which were on the short bolts. To a casual observer everything looked all right, and it was no fault of the rascally workman that a serious accident had been averted by the boiler inspector who put conscientious performance of duty above all other considerations.

Leave Journal Box Packing Alone.

With a view of protecting railroad property against a curious form of thieving which manifests itself especially in winter, Assemblyman Roberts has introduced a bill into the Rhode Island House of Representatives which is designed to punish persons who steal journal box packing from railway cars, engines, tenders, coaches or trucks. If the bill becomes law, fine or imprisonment will be the portion of such offenders when caught, tried and convicted. The maximum fine is $500, and the full prison penalty is three years behind the bars.

Journal box packing can be "hooked" easily enough without jacking the brass free, and it makes a first-class fire starter for the man who has it, but the lack of the packing often starts an undesirable heat in the box so robbed when the car is in motion, and the artificially produced hot box is a thing to be discouraged.

We have heard of men who cooked excellent ham and eggs on a fire so started, but who incidently caused much sadness to the car oiler at whose station the "defalcation" took place. Five hundred dollars for a meal or three years to think it over in, suggests an extravagance of money and time that few of these men would care to contemplate with composure.

Recent Railroad Patents.

Among the patents recently granted in connection with railroad appliances is one, 783,422, to Frank F. Coggin, of Portland, Me., for a heating system. The patent has been assigned to the Economy Car Heating Company, of Portland, Me.

No. 783,490 is a flue cutter patented by Mr. C. G. W. Wernicke, of Mankato, Minn.

Mr. F. B. Corey, of Schenectady, N. Y., has patented an emergency brake. This has been assigned to the General Electric Company, of New York. It is No. 703,508.

A railway signal has been patented by Mr. James Doyle, of Niagara Falls, N. Y. Its number is 783,511. It is a stop signal and is intended to apply the air brake in the emergency.

Mr. Wilbur C. Norris, of Tiona, Pa., has patented a stuffing box, the patent number of which is 783,644.

A truck bolster, patent No. 783,676, has been invented by Mr. Samuel P. Bush, Columbus, Ohio. It is a solid metal bolster composed of top and bottom plates and a cylindrical post connecting the plates at their center.

No. 783,718 is a sight-feed lubricator patented by William E. Bryant, Robert Davidson, and George M. Walcott, of Detroit, Mich., who have assigned it to the Michigan Lubricator Company, of Detroit.

A copy of any or all of these patent specifications can be had by applying to the Patent Office at Washington, D .C., and by sending ten cents for each specification. Stamps are not taken by the Patent Office.

To Enforce Safety Appliance Law.

With the intention of having the safety appliance law strictly enforced, the Hon. W. H. Moody, Attorney General, has recently issued a letter of instructions to all United States attorneys, in which he calls attention to the ruling of the Supreme Court, by which a locomotive is included in the expression "any car," as used in the act. The law forbids the use of cars which cannot be automatically coupled together by impact, and it was held by the court that the act applies to cars used in interstate commerce, whether empty or loaded.

In the letter referred to above the Attorney General says: "The government is determined upon a strict enforcement of these statutes. Therefore, any case of violation which is brought to your attention by the Interstate Commerce Commission or its inspectors, or by other parties, must be promptly and carefully investigated and suit for the statutory penalty be instituted and earnestly pressed if, in your judgment, the facts justify that course."

Largest Railway Station in the World.

The townspeople, of Leipsic, in Saxony, boast that in ten years they will have the biggest railway station in the world. It will be spanned by seven huge arches, each 140 ft. wide, and its thirteen train platforms will each be more than 1,000 ft. long, while twenty-six different lines will run into it. The estimated cost will be about $32,500,000. Marble, granite, bronze and steel will be freely used. The waiting and refreshment rooms are to have gigantic frescoes of famous German landscapes, and the beer taps are to dispense twenty different kinds of the beverage beloved in the Fatherland, so that travelers from every quarter may have their choice.

Japanese Railways.

The railways of Japan date practically from the accession of the present Emperor, Mutsututo, in 1867. In spite of opposition he ordered a scheme to be elaborated and in 1870 work was commenced at both ends of a line from Tokio to Kyoto, the new and old capitals of the country. It was to be continued to Kobe with several branches. On October 12, 1872, the first section, Tokio to Yokohama, 18 miles, was opened. As it was impossible to tell how the experiment of railways in Japan would answer, the first system was started in a very rough-and-ready fashion, and everything constructed as cheaply as possible. It was a single line with wooden bridges, running near to the sea and protected from it by embankments. Within a few years, however, this section was doubled and the bridges replaced by iron ones. At Ofuna, 29½ miles from the Shimbashi terminus at Tokio, a branch 10 miles long runs off to the Government Dockyard and naval station at Yokosuka. About a mile of this branch is spread over as many as 8 tunnels. So far as Yamakita, 58¾ miles, the course of the main line is fairly easy, but there a mountain range running at right angles to it has to be crossed and in 12½ miles a rise of 1,138 feet is effected. Gotemba, the summit of the bank, is 1,500 feet above the sea, but an equally rapid fall takes place on the other side. The extreme severity of this section may be judged from the fact that a gradient of 1 in 40 extends for 15 miles, in which distance from the summit at Gotemba the railway is only a little above sea level at Numadoza, having come down through 7 tunnels, totaling 1¼ miles in length. There are also a number of large bridges and some very sharp curves.

On the level section now reached is a bridge of nine spans, each of 200 feet, carrying the line across the river Fuji, a stream not only very wide, but which carries an enormous volume of water at times of flood. On account of the extraordinary velocity of the torrents at certain times of the year the substantial bridgework of the Japanese railways is a great feature. There are a great number of streams and the coast-line is much indented at places. From Numadoza, the line is generally near the south shore of the island, gradually rising and winding round the projecting bluffs. Tunnels are numerous but not of great lengths. Over the river Oi is a bridge of 16 spans, and over the Tenryn, one of 19 spans. The latter is nearly ¾ mile long, and is the longest in Japan. Beyond the Tenryn, for a long way the line lies low and marshy. From Toyokashi, 190½ miles from Tokyo, a rapid succession of valleys, rivers and tunnels, with glimpses of the sea, pleases the eye.

When Ogaki station is reached, 263¾ miles out, the character of the line changes. From the rice plains, with the numberless small bridges and culverts spanning the irrigation works, begins a 12-mile rise up to the Sekigahara pass, rising 750 feet in that distance. At Maibara, 284 miles out, we reach the large Biwa lake. For many miles the line follows the shore of the lake, crossing a number of rivers. At Kutsatsa, nearly 313 miles out, the Kansai Railway turns off. This belongs to a private company and runs some 50 miles to Yokkaichi on Owari bay.

At Baba, which is about midway across the island, there is a branch to the old terminus of the railway at Otsu, a port on Lake Biwa. From Baba the line rises and falls in gradients of 1 in 40, with some easier, and in 10 miles reaches Kyota. Another 50 miles of the same character country and the main line of the state railway ends at Kobe, 376½ miles from Tokyo.

At Kobe are situated the principal workshops of the line under the charge of Mr. R. F. Trevithick, a grandson of the immortal Richard Trevithick. The majority of the locomotives have been supplied by American and English firms, but lately two very fine consolidation engines have been built at the Kobe works. Some two-cylinder compound engines have also been built at Kobe from the designs of Mr. Trevithick, with cylinders 15 in. and 22½ in. diameter, with 20 in. stroke, and coupled wheels 53 in. diameter. The weight full is 40 tons.

The gauge of the Japanese railways is 3 ft. 6 ins. Doubts have been expressed whether this will be wide enough for future requirements, in view of the great increase in population and trade of the country, but as over 5,000 miles are now in operation, looking back is out of the question. The loading gauge allows the rolling stock to be almost as large as the standard, 4 ft. 8½ ins. Of course, the narrow gauge limits speed, but 40 miles an hour can safely be run.

One of the finest trains on the Government railway is the night sleeping car express, consisting of a luggage van, two second class carriages, a first and second class composite, a first class sleeper, a dining car, a composite second class and post office car. All are over 50 ft. long. The sleeping car has a side corridor and the train is vestibuled throughout, lighted by electricity and heated by steam. This train is worked over the different sections by different types of engines to suit the varying conditions of the road. Over the greater portion it is hauled by the four coupled bogie engines from the Schenectady works of the American Locomotive Company, having cylinders 16x22 ins., 60 in. drivers. There are 30 engines of the type, all built in 1902. Over the heavy gradients six coupled 8-wheeled mogul engines are used; some are tender engines and some tanks, but the latter

RAILWAY STATION IN JAPAN.

JAPANESE ALL-ROUND ENGINE.

are found to be most satisfactory, because of the extra weight on the driving wheels. Some of the moguls were built in America and others in England.

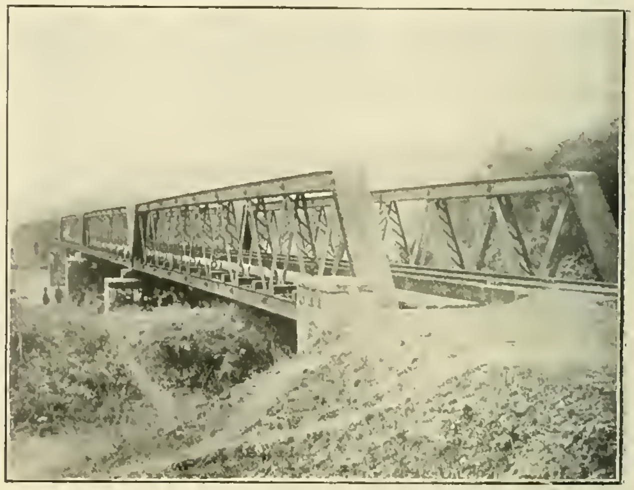
From Kobe, the western extremity of the island is reached by the Sanyo Railway, belonging to a private company, ending at Shimonoseki. Through trains are run from Kyoto over the state railway, and the run of 349 miles is made in 11 hours 20 minutes, an average of 30 miles an hour. The Sanyo Railway works are at Hiogo, where some of their engines have been built, but there are engines from the Baldwin and Schenectady works on this railway. The Sanyo Railway is fairly easy for the first 138 miles to Onomichi, the gradients not being more than 1 in 100. Some of the rivers on this section are particularly troublesome to the engineer's department, the rainfall being great, yet irregular, and the hills steep, great quantities of debris are liable to be washed down, choking and diverting the channels unless constant care is exercised. One of the bridges over the Tchi has 18 spans, each 70 feet wide, and 20 spans of 20 feet. At Saijo, 170 miles, the considerable altitude of 722 ft. is attained. The terminus, Shimonoseki, is a part whence a passage over to Kinshu is effected. In Kinshu there is a line, belonging to a company, from Moji, the landing place opposite to Shimonoseki to Nagasaki, near the western extremity of the island. Nagasaki is the principal town and port on Kinshu and contains a population of about 6 millions of people.

Returning to Tokio and setting out in the opposite direction, the Nippon, or Niphon, Railway Company's system is found at the Neno station, which is quite distinct from the Shimbashi terminus of the Tokaido or Government railway. Trains run to the northern part of the island, and the line ends at Aomori, a sea port. Generally, it keeps towards the interior of the country, but runs near the coast at Sendai. The first 38 miles, opened in 1883, are nearly level, after which an easy rise for about 70 miles brings us to a height of 1,330 ft. above sea level. It is then mostly down hill for about 100 miles. There is a short pull up to Sendai, where about 88 ft. is gained in 7 miles; then easy gradients prevail to near Mayesawa, 281 miles from Tokio. Then another heavy bit is encountered and a height of 1,490 ft. is reached at 355 miles, and a steady fall to Aomori, 454¾ miles, ends the line nearly at sea level.

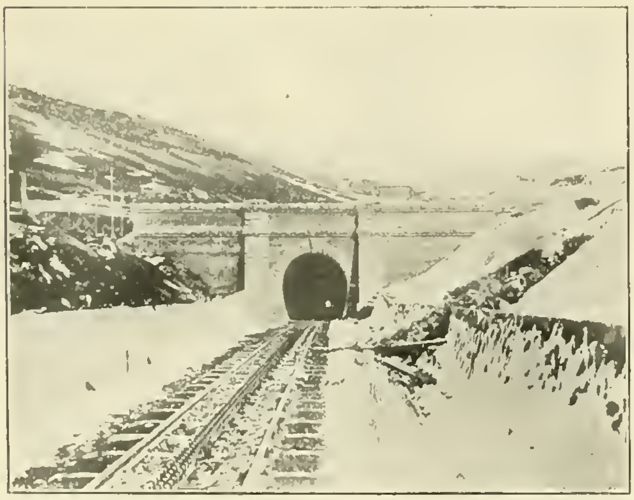
From Aomori there is a frequent steamer service across the Tongaru straits to Hokkaido, the northern island of the group. It contains a considerable supply of coal, but the distance is rather too far from the chief centers of consumption. Ten years ago there were over 200 miles of railway in Hokkaido belonging to the Tanko Company.

The western coast of Honshu is mostly served by branch railways, some belonging to the state, and some to private companies, leading directly or in-

JAPANESE SUBURBAN ENGINE. SPARKS SENT BACKWARD



A LONG BRIDGE ON JAPANESE RAILWAY.



RAILWAY SCENES IN JAPAN.

RAILWAY SCENES IN JAPAN.

directly from the Tokaido or Nippon lines. Space will not permit of a description of all, but perhaps the most interesting is that running to Novetsu. It leaves the Nippon line at Takasaki, 63 miles from Tokio, and 306 ft. above sea. In 18 miles it climbs about 950 ft. on a gradient of 1 in 40, but the next seven miles being too steep for ordinary rail adhesion, the Abt-rack rail is used. This difficult section was begun in March, 1891, and finished in April, 1893. There is a passing place half way. The gradient on the rack is 1 in 15, and the train is pushed up from behind by one engine. For extra heavy trains a six-coupled engine is used. These engines were built at Esslingen, in Germany, and by Beyer, Peacock & Co., of Manchester, England. They have cylinders 15½x20 ins.; drivers, 36 ins. diameter, and weigh 53 tons 12 cwt. The last 30 miles of this railway is frequently blocked with snow in winter and it is sometimes closed for two or three weeks at a stretch, due to the snow drifts.

Most of the coal used for locomotive purposes comes from Kinshu or Hokkaido, the islands lying at the two extremities of Honshu. It is brought to Yokohama by sea. Although rather smoky it contains little sulphur, and as it does not clinker much, the fires keep open and steam is made easily. As a rule good water is to be got, but at some places it is very muddy and frequent washing out is necessary. The worst foe to Japanese railways, however, is from below, and there is no warning of his coming nor can he be stopped. Earthquakes of extreme severity occasionally visit one or other of the islands. In 1891 over 120 miles of the central section of the Tokaido line were rendered useless by an earthquake. The embankments sank in 45 places, sometimes to the extent of 13 ft., and 63 bridges were destroyed. It took nearly 6 months to relay and repair the damage.

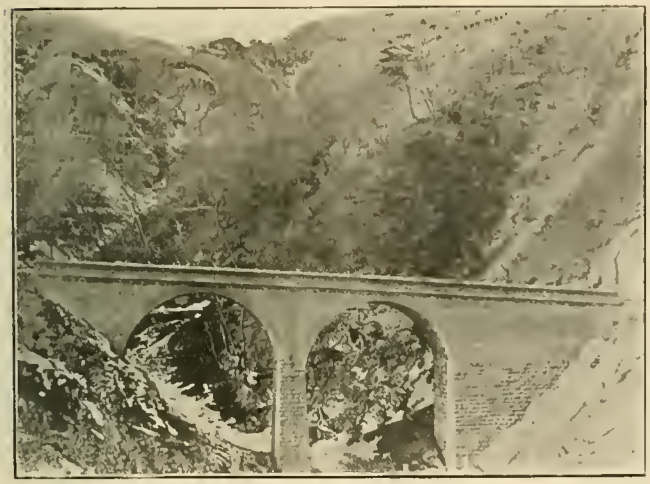
Japanese railway practice may be said to combine American and English ideas in many respects. Bogie coaches are now becoming common, but side doors in the British fashion are still adhered to. Goods wagons are almost entirely of the four-wheeled design. The permanent way is now of the American form, although formerly of the British type with chairs was used.

As in other countries, the working classes are the "mainstay" of the passenger traffic, and all the express trains, excepting the "night mail" on the Tokaido route, are made up of first, second and third class vehicles.

The automatic vacuum brake is in general use, and for single line working the train staff and ticket system is adopted. The total mileage open in 1902 was 4,493, of which one-third belonged to the state. There were 1,275 locomotives, 4,663 carriages and 20,317 goods wagons. The gross receipts were about $24,000,000 and the working expenses about $11,000,000.

Considering that the greater part of the system has been built within the last 20 years, in a country physically not well adapted for railways, it shows that the Japanese qualities of perseverance are very great. A. R. Bell.

Holme Dene, Ridgway, Enfield, Middlesex, England.



RAILWAY SCENES IN JAPAN

RAILWAY SCENES IN JAPAN.

"Against the Grain."

The general superintendent of the Central Division of the Canadian Pacific Railway, Mr. Geo. J. Bury, evidently means business in the protection of cars which are loaded with grain on his division, if one may judge from the vigorous tone of a circular recently issued by him concerning the nailing of grain doors in cars. He says:

"Cars and grain doors have been greatly damaged, and serious inconvenience has resulted in handling of grain at lake ports, by shippers nailing grain doors in cars. In the aggregate the expense and inconvenience has assumed such magnitude that extreme measures must be taken to stop this practice. Agents are required to see that grain doors are not nailed in cars at their station, and will notify shippers that persistence in the practice will result in legal prosecution. In any event consignors will be required to pay for the damage to rolling stock. The agent at Fort William will furnish each superintendent with a list of cars loaded on his district with grain doors nailed, so that it can be taken up with the consignors, and he will also see that the amount of the damage to the cars is charged against the grain."

Locomotive Also a Fire Engine.

The Union Pacific are supplying the freight engines used on the Wyoming Division with fire-fighting apparatus. The outfit consists of hose, hose reel, nozzle, and connections. This road has had trouble with fires starting from one cause or another, in some car in a train. In many cases there being no means of fighting the fire the burning car had to be set out on the nearest siding and abandoned to its fate. With the new equipment on each engine, if a car takes fire it can be placed on the nearest siding and the fire extinguishing locomotive ranged along side to do battle. It is probable that a considerable reduction of claims for damaged freight will be brought about by this arrangement.

Simplon Tunnel Finished.

The work on that great Alpine engineering feat, the Simplon tunnel, was completed a short time ago. Work on the "big bore" was begun on November 13, 1898. The tunnel was driven from both ends. The meeting of the two parties having the work in hand was signalized all over Switzerland by the booming of cannon and the ringing of bells.

The length of the Simplon tunnel from Briga, on the Swiss side, to Iselle, on the Italian side of the mountain, is about 12 miles. There have probably been more obstacles encountered in the piercing of the Simplon mountain than have been met with in similar engineering undertakings of modern times. The most serious was the sudden bursting in the tunnel of a spring of hot water which temporarily drove the workmen out and greatly retarded all operations during the days in which it flowed. The water at one time was at 131 degrees Fahrenheit, and the atmosphere had to be artificially cooled by the engineers in charge before work could be continued.

The governments of Italy and Switzerland have jointly financed the undertaking at a cost of about $15,000,000. The work is regarded as one of the greatest engineering achievements of the age.

The Simplon road which goes over the pass of that name, leads over a shoulder of the Simplon mountain. This mountain attains a height of 11,124 ft. The road at its highest point is 6,592 ft. above sea level, while the level of the tunnel is 2,312 ft. above the sea. The Simplon road was begun in 1800, under the direction of Napoleon, and was for military purposes; it was finished in 1806. It is a carriage road about 25 or 30 ft. wide, and its maximum slope is 1 in 13. It is 42 miles long and is carried over 611 bridges and through numerous galleries cut in the rock. There are a number of houses of refuge built along the road for the shelter of travelers. The opening of the tunnel to railway travel will reduce the traffic over this famous military road. The tunnel route is expected to shorten the rail journey from Paris to Milan by about eight hours.

Buying for a Railroad.

A pin would appear to be of little use on a railroad, yet the Santa Fe finds it necessary to buy one and a half tons of pins every year. Where they all go to nobody knows.

The pencils used in twelve months by employees of the Santa Fe would, if laid in a straight line, reach a distance of more than 25 miles.

The Santa Fe used 26,000 brooms in 1904—the new kind that sweeps clean. All old broom handles are returned to headquarters and sold for a snug sum of money.

It takes more than 1,000 pen points a day (just 396,000 annually) to supply Santa Fe employees who take a pen in hand to write these few lines, etc. This army of pens consumes fifty barrels of ink, and the resultant documents are bound together with 13,000 pounds of rubber bands. The printed forms used by the wielders of the pens would fill fifteen carloads during the period named.

Railroads do not hold public rummage sales, but they manage to quietly get rid of a lot of second-hand stuff in a way that brings many dollars into their coffers. The Santa Fe, for example, receives about one and a quarter million dollars each year as revenue from the sale of scrap material. Even the junk heap is not to be despised. This is quite a respectable contribution toward the total amount spent for supplies, which totals $21,000,000 annually.

The locomotives on the Santa Fe system burn 2,000,000 tons of coal in one year and 3,500,000 barrels of oil. The problem of making the wheels go round is a big one, when reduced to terms of fuel. The oil-burning engines are in Arizona and California, and in that section the tracks are oil-sprinkled.

Fireman Suing Himself.

An extraordinary lawsuit is pending in an Ohio court in which, among others, a member of the Brotherhood of Locomotive Firemen is suing himself. Frank N. Gear, secretary of the Forest City Lodge of Locomotive Firemen, obtained an injunction against that organization and its grand lodge, restraining them from expelling him from the order. As secretary of the lodge he was required to name himself one of the defendants. The association filed a motion to dismiss the case, claiming that a man cannot be both defendant and plaintiff in an action.

Gear alleged that he was threatened with expulsion because he refused to pay dues at a time specified by an amendment to the constitution. He claimed he paid his dues in accordance with the original constitution before the amendment became effective. Therefore, he declared, the amendment cannot apply to his case before the expiration of the fiscal year, June, 30, 1905.

Wood Preserving.

Railway companies are, as a rule, large wharf owners, and as the question of wood preservation in these structures is of great importance to them, the subject was dealt with in a paper read a short time ago before the Pacific Coast Railway Club by Mr. James McKeon, who is the secretary of the Mill Owners' Association of Oakland.

Among other things, the speaker said, the frequent repairs to and renewals of wharves, piles and bridges are at the present day a great source of annoyance to commerce and expense to the great corporations. It may be stated that piles used in wharf construction in salt water are quickly destroyed by the teredo, the limnoria and other marine insects. Caps, stringers and other timbers used in wharf construction are destroyed by the action of the atmosphere, called dry rot. This is a process of decay in which the timber becomes thoroughly soaked with water during the rainy season, which causes it to expand in some degree. During the dry season the moisture exudes and the pores and fibers are left open to absorb water when the next rain comes. Under these conditions fermentation takes place and in a few seasons it has become practically useless. Dry rot has consumed its fiber and destroyed its tensile strength. Telegraph poles, posts, railroad ties and other timber in and adjacent to the ground are soon destroyed through similar atmospheric action. In some localities the destruction of timber is greater than in others owing to the nature of the soil.

In England some sixty years ago, the creosoting process was put in use for preserving wharf piles and timber for superstructures. It has been used in many countries with various results, but in no case with entire success. Even partial success cannot be had unless the timber is of a soft and porous nature. Creosote being volatile and having little or no adhesive properties, is destroyed by saline action and is quickly removed by wave and tidal action, and if washed from the timber to even a depth of 1/16 of an inch, the limnoria attack the timber and continue operations until the timber is eaten through.

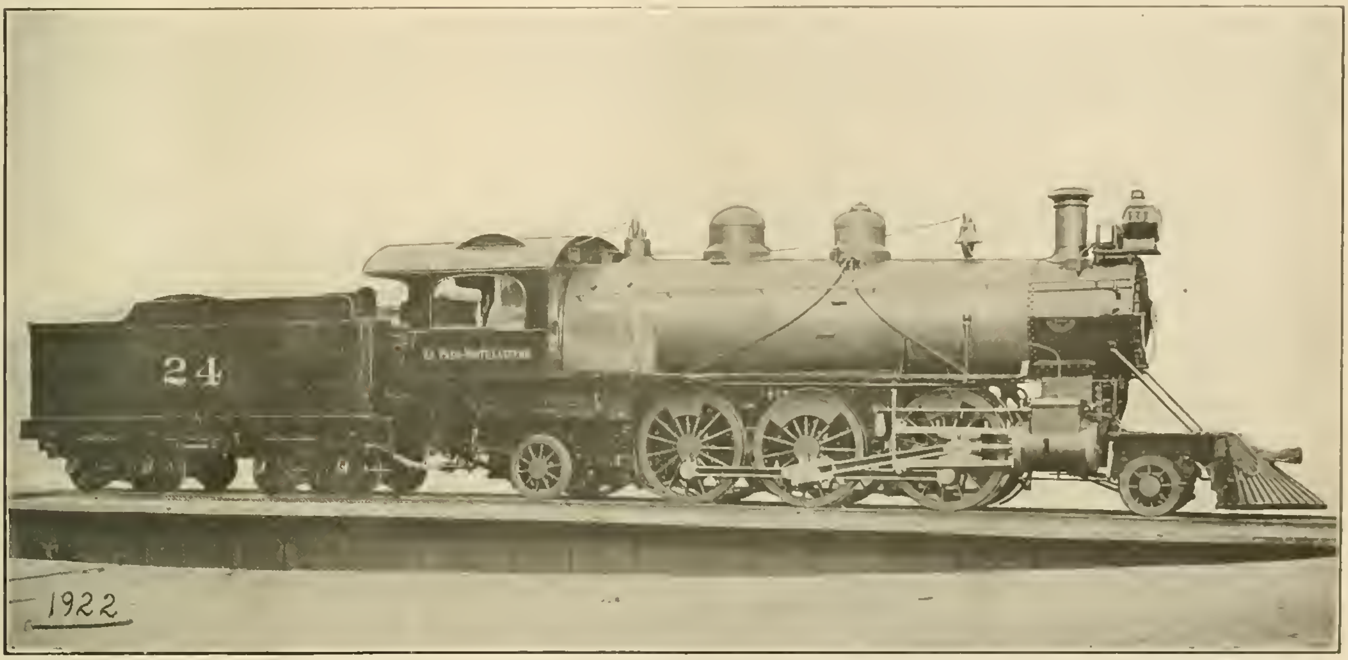
Creosote of any value must be imported from Europe. It must be of the best quality, and the impregnation must be thorough and it takes from 14 to 19 lbs. to the cubic foot. In California 10 lbs. is about all that can be injected into the timber available for wharf construction.

To sum up, the essential qualities necessary to preserve timber are that the timber must be mechanically prepared, convenient and reasonably cheap. The sap must be removed from the outer portion of the pile for a depth of about one inch, and in doing this the fibrous and tensile strength of the timber must not be impaired. Material must be produced which will resist the corrosive action of ocean water. The material applied must be such that it indefinitely resists the motion of waves or of the tide.

Prairie for the N. M. Railway & Coal Co.

The New Mexico Railway & Coal Company have recently received from the Baldwin Works, of Philadelphia, some 2-6-2 engines for the El Paso Northeastern System, which we here illustrate.

The engines are simple and have 21x28 in. cylinders, and 69 in. driving wheels. The steam pressure is 180 lbs., and, with 85 per cent. of this considered as the mean effective pressure in the cylinders, the calculated tractive effort of these engines is about 27,300 lbs. The valves are balanced slide valves and the motion is indirect. All the rods are I-section.



PRAIRIE TYPE ON THE EL PASO NORTHEASTERN.
E. Dawson, Superintendent of Motive Power and Machinery. Baldwin Locomotive Works, Builders.

The fire box is of the wide type, being 71¼ ins. across and 108 ins. long This gives a grate area of 53.4 sq. ft The heating surface is, in all, 3516.2 sq. ft.; tubes 3331.2, and fire box 185 sq. ft. The boiler measures 66 ins. at the smoke box end. The tubes are 2¼ ins. diameter in this boiler and there are 299 of them, and they measure 19 ft. long.

The tender is of the ordinary U-shaped pattern, the tank has a water capacity of 7,000 gallons. The underframe is made of structural steel, and the tender trucks are of the ordinary arch-bar type with eliptic springs. Some of the dimensions of these engines are as follows:

Boiler—Type, wagon top; thickness of sheets, 9-16 in. and ⅝ in.; staying, radial.
Fire Box—Material, steel; depth, front, 75¼ ins.; back, 65¼ ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, ½ in.; water space, front, 4½ ins.; sides, 4½ ins.; back, 4 ins.
Driving Journals—Main, 10x12 ins.; others, 9x12 ins.
Engine Truck Wheels—Front, diameter, 33 ins.; journals, 6½x12 ins.
Carrying Wheels—Back, diameter, 40 ins.; journals, 7½x12 ins.
Wheel Base—Driving, 13 ft. 4 ins.; total engine, 31 ft. 6 ins.; total engine and tender, 61 ft 7½ ins.
Weight—On driving wheels, 124,980 lbs.; on truck, front, 23,300 lbs.; on truck, back, 37,200 lbs.; total engine, 185,480 lbs.; total engine and tender, about 315,000 lbs.
Tender—Journals, 5½x10 ins.
Service—Passenger.

Setting the Frames.

BY JAMES KENNEDY.

Organic defects in locomotive construction are so multitudinous and so pernicious in their effects that it is not unreasonable to expect that the march of human progress will see the establishment of a method of State inspection of machine construction, and, for as good reasons as we now see inspectors of buildings and, let us hope, with more enlightenment and honesty of purpose.

In commencing the construction of locomotives on the erecting floor, the most casual observer cannot fail to have been struck by the rapidity with which the principal parts of the machine are attached to each other. The frames, saddle, cylinders and frame braces are literally slapped together. Those who have had the opportunity of witnessing the beginning of the building of a ship can testify to the fine care with which the keel is laid. Rude and ponderous as it is, it is set with the finest nicety. The shipbuilder knows that everything else attached to the mighty structure hangs on the laying of the keel. The wedging and leveling and plumbing and squaring of the single important part occupies considerable time, and not until the keen eye of the master shipbuilder is perfectly satisfied can the work proceed.

With the locomotive master builder it is different. His desire is to see the foot boards up, and the dome casing on, and the cab dropped on its place, and the tank run in, and the painters at work with their putty knives and their paint pots covering up a multitude of sins, and then his mind is at rest.

Let us go back for a moment and see if the frames of our engine are at rest. The saddle should be examined before the frames are attached to it in order to ascertain whether its planed surfaces are parallel to each other or not. This is not by any means always the case. It will generally be found that by trying two long straight edges on the planed surfaces and carefully measuring the distances that the straight edges are apart that at the distance of ten or twelve feet from the saddle a deviation is more or less apparent.

Should the distances apart slightly diminish as we move backwards, the effect will not be so serious as if the distance increases from the fact that the greater heat on the frame braces adjacent to the fire box of the engine will cause a larger transverse expansion in that part than nearer the front of the engine.

But assuming that the sides of the saddle are parallel the frames should be squared by the front pedestals. The process of leveling the frames and saddle should be done with the utmost care and the holes marked for drilling on the saddle from those already in the frame or vice versa, as the case may be. If both frames and saddles have been drilled from templates, as is often the case, a perfect adjustment of the frames to each other is almost impossible of attainment.

These remarks, of course, are only applicable to locomotive construction where the saddle is entirely separated from the cylinder. In the construction of a certain class of locomotives wherein half of the saddle is cast with each cylinder, the test of the accuracy of the planing work comes when the central surfaces come together for adjustment. On being bolted together the position of the frames should be carefully tested in order to observe if they are perfectly parallel and their parts at right angles to each other.

Perhaps the worst treatment accorded to the frames occurs after the cylinder studs have been fitted and tightened in their places when keys are fitted at the ends of the cylinders resting against projections or shoulders on the frames. These keys, generally of hard brass or bronze, and sometimes a couple of feet in length, are driven with great force into the space alluded to with the effect that the frames are warped inwards to such a degree that the front pedestals are nearly always considerably affected by the unnatural pressure of the keys. When a frame brace has been fitted between the frames near the saddle previous to the driving of these keys, the brace will be found to be difficult of removal, and if removed it will be found almost impossible to again place it in its position. Not only are these keys the direct cause of many fractures in the frames near the front pedestals, but the twist given to the pedestals themselves is such that the driving boxes and wedges are kept continually at war with each other, and the effect will readily be seen when, after being in use for some time the wedges and pedestals are examined the sides of the wedges are seen to be cut into near the bottom on one side and near the top of the wedge on the other side, showing that the frames are not square to each other. Such keys, if at all possible, should be avoided, and if there are a sufficient number of studs attaching the frames, saddle and cylinder to each other and are properly fitted, such keys are not only entirely useless but their effect on the frames are always of the most pernicious kind.

This is not all. As we progress backward along the frames it will be found that there are generally strong braces securely riveted to the boiler and bolted to the frames. It does not require a great stretch of imagination to see that when the variation of the boiler occurs under the effect of the varying temperature, something is going to happen, and it is well if a broken bolt or two is all.

Perhaps the greatest strain that the frames undergo, however, is near the fire box. There the greatest degree of expansion and contraction is constantly occurring, and it is a strange fact that while our mechanical engineers have instituted many devices to obviate the strain of the expanding boiler in a lateral direction, little or no attention has been given to the transverse or cross expansion which has been already alluded to. In repairing locomotives it is generally found that the bolts in cross braces attaching the frames near the fire box are nearly always broken or cut into, while the bolts attaching the link hangers by which the boiler is flexibly suspended, are unhurt.

It is certainly a difficult problem to conceive of the construction of a brace holding the frames rigidly together and still adjusting itself to the variations of temperature, but other means of suspending the boiler might be discovered by the use of rollers or other movable bearings.

That the frames of American locomotives are defective in rigidity is generally conceded, but in point of adaptability to the attachment and general use of the many mechanical appliances necessary to the modern locomotive they are infinitely superior to the double riveted boiler steel sheet frames of European locomotives, and only require a greater care in the constructive detail of setting up and, perhaps, with a little more of the exercise of American ingenuity in certain directions, which have been dimly hinted at in the construction of the locomotive generally, a nearer approach to perfection might be attained.

As it is, few frames are seen on engines of long service without the earmarks of fractures of some kind or other about them. In the blacksmith shop the welding of a broken frame is one of the most difficult operations known to the trade. In the machine shop they are the anguish of the planing machine and slotting machine men. On the floor the work necessary in taking off a broken frame and fitting it up again is almost equal to rebuilding an engine, and it is safe to say that with finer care in the original setting up of the frames, and the exact mechanical adjustment of the various frame braces, and the entire absence of the worst of the disturbing influences at work, most of these costly fractures could be avoided.

It is a fact not generally known, or, at least, not largely advertised, that the best constructed locomotives are those whose existence is owing to some careful master mechanic in a roadside repair shop in some part of the country. Perhaps it is the work of months that widened into years, but, like the building of King Solomon's temple, there was a master mind overseeing it and there was no confusion. It grew slowly, but it blossomed into perfection. Its original cost is an unknown quantity. The honor of running such an engine is looked upon as a royal honor. Disaster may overtake it, but even in disaster there is a firmness begotten of strength about it. Such locomotives are to be seen here and there and known once or twice in a lifetime. Like angel visits, they are few and far between. Like a tree that the fiery finger of summer has clothed with scarlet and gold while the others are but russet or brown, it glows the glory of the forest. Like a rapt poet among his fellow-men, a mysterious finger has touched him and he seems to dwell apart.

Let us hope that we are approaching a higher degree of perfection in mechanism, and, meanwhile, it is fortunate that a popular organ like RAILWAY AND LOCOMOTIVE ENGINEERING, circulating largely among men whose lives are spent in the construction, repairing and running of American locomotives, opens its pages and cordially invites discussion on the growing details of the vast industry relating to the mechanical appliances used in railway traffic. Earnest opinions as to the best methods of obtaining the best use of such appliances are of value especially to the thoughtful of the younger men whose aim should be to know all that is to be known in the high calling which they have chosen.

Long Span Bridge.

There is now under construction across the St. Lawrence at Quebec a cantilever bridge which, when completed, will contain the longest span of any bridge yet erected, not even excluding the great cantilevers of the Forth Bridge in Scotland The structure consists of two approach spans of 210 ft. each, two shore arms, each 500 ft. in length, and a great central span 1,800 ft. in length.

The total length of the bridge is 4,220 ft., and although in extreme dimensions it does not compare with the Firth of Forth Bridge, which is about one mile in total length, it has the distinction of having the longest span in the world by 90 ft., the two cantilevers of the Forth Bridge being each 1,710 ft. in length.—*Scientific American.*

The New York, New Haven & Hartford Railroad has experienced an amazing number of troubles during the winter that seriously delayed trains. In one day there were blockages from a broken tender axle, a derailed freight train, a sleeper off the track and a derailed milk train. When similar experience is spread all over the month it gives cause for bitter complaint from patrons.

General Correspondence.

Engine Failures—Use Both Injectors Regularly.

Editor:

We have from time to time read essays on the management of locomotive boilers written by the shopman and officials in charge of the mechanical departments; we are told of methods in vogue on some roads of changing the water without entirely reducing the steam pressure, and various other methods have been formulated and explained which are undoubtedly calculated to extend the life of the boiler; while from the standpoint of the engineer we do not hear enough. All the "shop kinks" that have been introduced will not be of much avail when improper methods of firing and pumping are practiced.

It is the universal practice on a majority of our railway lines, especially in the winter months, to continually feed the boiler with one and the same injector; in cold weather the "frost" cocks are kept open on one side, while all the feed water goes in from the other side, and this continues in some cases from one shopping of the engine until the next, and the result is that the feed water deposit of lime, mud, etc., is very much in evidence on the flues and around the check on the side pumped, while around the opposite check chamber boiler is reasonably clean; it has been the experience of the writer that this one-sided accumulation of mud is not a good thing for extended service in the life of the boiler. By convection we are taught that the hotter parts of the water are continually taking the place, that is, changing with the cooler portion, which means, of course, good circulation, and the more the free circulation of the water is impeded the poorer the steaming qualities, and it is but reasonable to believe that good circulation cannot be maintained through the cylinder portion of the boiler when an over abundance of this feed water deposit is on one side and practically nothing on the other.

FIRST LOCOMOTIVE BUILT IN TORONTO, CANADA, IN 1853, BY JAMES GOOD, FOR THE ONTARIO, SIMCOE & LAKE HURON RAILWAY, NOW PART OF THE GRAND TRUNK SYSTEM.

If observation from an extended experience of a quarter of a century as a locomotive engineer "cuts any figure," then it is the experience of the writer that this one-sided practice is more or less detrimental; and what about the expansion and contraction of the flues? Is it rational to argue that with a portion of the flues free and the other portion for at least one-third of their length covered with sediment, thoroughly baked on, will expand and contract evenly? Is it not possible that in this matter alone one of the causes for engine failures might not be traced? The writer has made it something of a study, and has at times investigated the condition of boilers where different methods of pumping have been practiced, and the belief has been firmly established that it is good practice to try, as far as possible, to have the amount of water fed to the boiler divided between the right and left injectors.

It was the practice of your "scribe" for years to have the fireman do all the pumping around stations and while lying on sidings; between stations the injector on the right side was used; in freight service this plan works nicely; while the engineer is switching and busy with throttle and reverse lever the fireman has the most time and can best look after the water supply; between stations the engineer has the time and should make it a part of his duties.

There is much more that can be said in favor of this form of feeding the boiler. It is not good practice to have one injector continually out of service; the one not in use may be badly needed on short notice, and almost any engineer of much experience can tell you, if he will, that the injector, like the Irishman's flea, "is not there when you get your finger on him," at least not on all occasions.

It is the experience of the writer that it is a poor policy to have one of the injectors out of commission, no matter how cold the weather It is not a necessity. It is true that it makes lighter labors for one or the other of the enginemen, but good engine management demands that both injectors should at all times be ready for immediate use. Starting the injector and allowing it to work for a few seconds, then close overflow valve and blow steam back for a few moments, will put an injector and connections in condition to prevent ice forming for at least an hour with a zero temperature.

The practice of continually having steam blowing through an injector soon rots out tank hose and impairs other working parts.

In extreme cold weather good results are obtained by making "blow backs" of the injectors when tanks are full of water. At such times it is far better, when the pop valve must lift, to divert the steam to the water than to allow it to be wasted in space.

It is a nice thing for the engineer when he can turn the steam on his injector and allow the fireman to do all the pumping, and a great many firemen are imbued with the idea that they should at all times be allowed to do the pumping, and there is no doubt there are some firemen who use better judgment than some engineers in boiler feeding, but that does not do away with the opinion as heretofore expressed, that good practice demands the use of both injectors.

The engineer that permits the fireman upon all occasions to pump the engine is neglecting a duty that may make trouble for himself should he have a "green" fireman; after weeks, perhaps months, with no attention paid to the pumping, the engineer is liable to forget; the writer has known of good engineers getting into trouble from this cause.

If this article meets with the approval of the editor of Locomotive Engineering the author will in a future number have something more to say regarding best methods of boiler feeding and firing, as viewed from his standpoint.

By following the methods described on the foregoing pages and having other fixed rules regarding firing, as well as pumping, the writer, when having a regular engine consigned to himself, was fortunate enough to have his engine, after coming out of shop, make from forty to fifty thousand miles before flues began to give much trouble.

J. W. Reading.

Grand Rapids, Mich.

The Erie Problem of Train Hauling.

Editor:

Your comments on the above subject in the March number interested me very much. It seems curious to me that locomotive builders do so much guessing about what engines can do instead of working out on scientific principles the various problems of train hauling. The Erie case reminds me of the time when the Baltimore & Ohio Railroad wanted an engine to haul a train of eight Pullman cars up Altmont grade, seventeen miles long, of 116 feet to the mile, in 35 minutes. One concern claimed that they had an engine which would do the work, and I told my informant that there was not a locomotive in the world that could do it. The engine was tried with a train of six cars, instead of eight, and the best time made was 65 minutes. Indicator cards were taken, and they proved that the engine was doing all the work within its capacity.

While agreeing with most of what you say, I make one reservation. As a prophet you are a rank failure. Why can't you leave that to Alexander Dowie and his like? Looking into the future seems to be beyond your sphere. I learned to figure in my young days, and now with the help of a pencil I make out that it is very probable that an engine could be built that would haul the Erie train on its schedule time, but I am also doubtful if it would pay.

Experience.

Camden, N. J.

Effect of Counterbalance Weights.

Editor:

Tests conducted at Purdue University several years ago for the purpose of finding out something new in counterbalancing developed the fact that the locomotive driving wheel lifted from the rail at speeds exceeding 59 miles an hour. This was ascertained by passing wire through between rail and tread of wheel, portions of the wire showing no effect whatever, while the rest was flattened by force of contact between wheel and rail. This test was made with a locomotive worked with her own steam, in the usual way, but held stationary, her driving wheels turning on rollers.

In the first place this locomotive, operated under the conditions named, was not a locomotive in the true sense; was not designed for the kind of service under which the test was made, and any peculiar action shown while operated under these conditions could not rightfully be called peculiarities of the locomotive. Plainly stated, the locomotive driving wheel is balanced for the purpose of making the engine ride smoothly at a speed called for in the service the engine is to be used, and the riding of the engine is the real "proof of the pudding." If the engine is not run she cannot be said to ride, and any tests made by a locomotive held stationary would be useless as proof of her action under normal conditions of service. This is particularly true of the effect of counterbalance in driving wheels, and if the test referred to proves anything, it is that a locomotive driving wheel perfectly balanced will (when engine is held stationary, but driving wheels revolved on rollers) raise from the rail because of the wheel being out of balance for a purely rotary motion.

Many engineers have no doubt noticed a kind of lifting, or humping motion when an engine is slipped violently when starting, yet that humping is not there when slipping takes place, at a speed above, say, forty miles an hour.

Driving wheels balanced for the motion developed in service are overbalanced for a motion that is purely a rotary one, for the test referred to showed the wheel raised from rail when counterweight was up. Operated normally weight modifies its vertical or lifting force, and that explains why engineers have not noticed that the driving wheels of their engines rise from the rail, or rather because they do not do so when operated under normal conditions as a locomotive.

T. P. Whelan.

[We are always ready to permit practical questions of this character to be discussed in the columns of Railway and Locomotive Engineering, although, as in this case, we differ from the views of our correspondent. We cannot see why the actions of the counterbalance weights should act differently on the road from what they do on a testing plant.—Ed.]

The Straight Link.

Editor:

Being a reader of your Railway and Locomotive Engineering, and having had a little discussion on valve motions, I was told the Henssinger von Waldeggs (Helmholtz System) or straight link, is the modern and most efficient of all. It has constant lead and gives full port opening quicker than others, or after 3¾ or 3 15/16 ins. piston travel. Would you please give a description in your journal of this valve motion and its effect with diagrams, if not too much trouble, as it may be interesting to many a reader fond of knowledge in these parts. This motion was used on the engine of the Swedish State Railways, shown in one of your journals last year, and is used in that country very much.

Chicago, Ill. August Nelson.

[The straight link, known as the Allan, is well known to engineers, but is not of sufficient importance to call for illustration. Instead of being better, the straight link is inferior to the curved link as a means of distributing steam. The feature of giving constant lead, so much praised by European engineers, is considered a defect on this side of the Atlantic.—Ed.]

Adding Weight and Reducing Size of Drivers.

We are all very much interested in certain changes they are making on an engine on this railroad. She is a standard engine with cylinders 18x24 ins., driving wheels 66 ins. diameter, 28 tons on the drivers, and 18 tons on the engine truck. The boiler carries steam at 160 lbs. pressure, and the engines are very slippery.

They are now remodeling one of these engines by putting in 62 in. driving wheels and applying a cast iron deck weighing 4,200 lbs. and 1,500 lbs. of lead around the steam dome. The forward end of this cast iron deck sets over the center of the back driving box, and extends back 4 ft. 6 ins. to back end of the frame, and the distance from the center of the main driving axle to the center of this cast iron deck is 10 ft.

After these changes are made will engine slip as before? Will there be any benefit derived?

Kindly advise me as to what you think. R. A. B.

Marquette, Mich.

Answer.—[Before the change was made the tractive power of the engine was 16,048 lbs., and the weight on the drivers 56,000 lbs., making the coefficient of adhesion nearly 3.5, which is very low. After putting on 5,700 lbs. extra weight and reducing the diameter of the driving wheels to 62 ins., the coefficient of adhesion will be 3.6, about the same as before.—Ed.]

Cylinder Bushings.

Editor:

Considerable difficulty is often experienced in applying cylinder bushings to locomotives, especially in cases where the bushing is very thin. If anything occurs to prevent the bushing passing readily into the cylinder, the bushing soon becomes heated, thus expanding the bushing and causing the same to stick.

To overcome this difficulty on our road we use a wooden head in each end of the bushing placed up against the end of the counter bar, with a ⅞ in. rod through the center and a hole bored in one end for the purpose of filling the bushing with cold water. After filling the bushing with cold water, we plug the hole.

By the use of this method we can use several minutes' time if necessary in applying bushings to cylinders with absolutely no danger of the same heating and expanding the bushing. S. B. A.

Boone, Iowa.

"Omaha" Fast Freight Train.

Editor:

I send you one of my photographs, "Fast Freight on the C., St. P., M. & O. Ry.," hoping that you will see fit to illustrate it in your valuable paper.

This picture was taken with one of the most rapid anastigmat lenses, and the exposure was the 1/150 part of a second. Such a shortening of exposure as this (which is absolutely necessary in the successful photographing of moving trains) usually results in a great sacrifice of detail, but this picture looks more like a time-exposure than a "snap-shot." This is the combined result of using a lens which admits a vast amount of light in the shortest space of time, and the most sensitive of dry plates.

Trains on the "Omaha" do not usually send forth such an abundance of smoke, but our fireman, wishing to make the picture as attractive as possible, threw in a large quantity of coal just before coming within range of the camera; therefore, to him is due most of the credit for good appearance of this photograph.

J. Foster Adams.

Fairchild, Wis.

FAST FREIGHT ON THE C., ST. P., M. & O. RY.

Engineer and Engine Driver.

The following letter was sent to *Success*, but was refused publication:

I enter a protest against the remark in December *Success*, that twelve years ago Daniel Willard was an engine driver. There is no such expression as "engine driver" in the English language as it is spoken in America. The correct and popular name in the United States for the man who manages a locomotive is "locomotive engineer." He is that by the voice of the people, and none but unworthy imitators of English practices call him an engine driver. The man performs sufficiently important duties to justify people in classing him as an engineer. There was no attempt to belittle him into an engine driver until the crowds of college graduates a few years ago began claiming exclusive right to the term engineer.

When a name becomes popular with the public, arguments or counterclaims will not change it, and locomotive engineer will by that power cling to the man who runs a locomotive as long as there is a locomotive to run. The man who manages a locomotive is well entitled to the name of engineer. He is chief engineer of all the complex mechanism comprising a train of cars. Watch him at work managing the engine pulling a heavy express train on a stormy night. He sits with his vision piercing the darkness, ready to detect cause for stoppage or reduction of speed, which may appear in a variety of manifestations which none but a man of experience and skill could understand. With his eyes on the outlook, his mind controls the engine in all its moods. He is probably co-operating with the fireman to make the boiler steam under difficulties; he is watching the water in the boiler and regulating the feed to suit the work the engine is doing; he is noting the air pressure and taking care that the air pump keeps up its regular beat; he notes the least false note in the engine machinery, and is alive for any indication of disorder to the train mechanism. During all this steady mastery of his business a storm of wind, rain, hail or snow may be raging louder than the tumult of the engine, but the competent engineer knows exactly how fast the train is running and every landmark flashing by is familiar as the furniture in his cosy parlor at home. The man who exercises all that power has the right to carry a higher title than the man who drives the horses of a lumber wagon. Be just to the man if you fail to be generous.

ANGUS SINCLAIR.

Inviting Accidents.

Editor:

I read your views relative to the disposition of medals awarded men of daring, and cannot refrain from expressing to you my views on same subject, as my opinions are based on practical experience in the ranks. Four generations of my family have served the N. Y. C. & H. R. R. R. and the little R. Rs. of which it is composed, every moment since my grandfather assisted in the building of the Syracuse & Utica R. R. in the "thirties" to this date. In my thirty-eight years of railroad experience I have held all positions from that of errand boy, section hand, brakeman, conductor, fireman, and, to put it briefly, every position in the operating department up to assistant superintendent of transportation, excepting those of telegraph operator and engineer, but with four years on "the left-hand side" with a shovel, gave me a pretty fair idea of the "head end." I was born in a station and brought up in one: hence I feel qualified to give an opinion, and I desire to say that my observation of affairs in the railroad service entirely corroborates that given by you, above mentioned. My home is right beside track No. 1 of a trunk railroad, about equi-distant between the home signal and the advance signal of tower No. 32, governing traffic on main track. Trains east bound held by advance signal on this track stand so their tail ends are directly opposite my house and are only about 35 feet away, so I really have a good chance to observe. The past two winters have been exceptionally hard, both in temperature and the frequency of storms. A division station is four miles away, where all trains stop, hence near every train catches a block here when they are "off time." I have watched flagmen night and day while trains were standing waiting to get a clear block and I have never caught a man back far enough to hold a train if there was any occasion to do so. To add to the seriousness of the situation it is only one-fourth mile straight track where an engineer could see clearly as a train approached the tail end. Supposing the tower man cleared his distant and home signals; let a train down to the advance; is suddenly stricken with death or sickness before he could throw his distant or home signal to protect train. Flagman cannot know whether the blocks are up to hold following trains in the night or in a heavy storm, and yet they hug the tail end. They know it, I know it, and as I have called the attention of the railroad officials to it, I know they know it. Yet it occurs nightly.

If those in authority will countenance the taking of chances how are we to expect the rank and file to "get back and swing a lamp?"

I glory in your expression of an opinion, tersely put and so strong that it will carry conviction to those who read. May it be a flag to the careless and a clear block to the faithful.

I commend your contention that men who do their duty faithfully at the times which try men's souls and test their constancy are the real heroes of railway life, and ought to be so rewarded.

DUTY.

Dealing with Breakages.

Editor:

Speaking of disconnecting modern locomotives in cases of damage to side rods, that is, locomotives where the eccentrics are coupled to the second pair of driving wheel shaft, and main rods coupled to third pair driving wheel shaft. As a general rule, the books we read nowadays explain that if the right main parallel rod is broken all side rods must be removed and the engine taken in tow for the shops. When all side rods are removed from a locomotive, as above indicated, of course it becomes necessary to tow the engine in. But it requires considerable power to draw a 100-ton locomotive in tow, and the power required to bring a disabled engine of the above weight to the shops could be used to better advantage to draw freight upon which something could be realized, having the crippled engine brought to the shops under her own steam.

To illustrate: Suppose we have one of the modern heavy type of locomotive, with eccentrics connected to the No. 2 driver shaft, and the main rods connected to the No. 3 driver shaft, the right main parallel rod breaks, I cannot see any valid objections to removing all side rods on the right side of the engine, removing also the rear and forward sections—side rods—left side, leaving the left main parallel up; this, then, will keep the eccentrics in their proper place with relation to the main pistons, maintaining the necessary distribution of steam. Of course, it is understood that the knuckle pin joints of side rods are in the rear of the main crank, and forward of the No. 2 crank pins of the engine we are speaking of here. It may be well in passing to mention the fact that the locomotive engineer in charge of a breakdown of this nature should be a man of good average judgment, and when the necessary disconnections are made and he is ready to proceed he should be mindful to have the reverse lever in full forward motion when making the start; this will permit of the largest port opening it is possible to have; the engine can then be moved with the lowest steam pressure, preventing slipping of driver wheels, and after the engine has picked up in speed the lever can be notched back to about half stroke, reducing to a minimum possibility of slipping of the driver wheels. Speed should not exceed 10 miles per hour. In bringing the engine to a stop care should be exercised not to bring the engine to a too sudden stop, the reverse lever should not be used. Stop to be made entirely with the brake. In this case we have both main pistons and valve motion as before the accident, and in getting this engine started with her own steam, without slipping, is a test for the judgment of the man handling her. A locomotive engineer having confidence in his ability and using the proper judgment can bring this engine to the shops without additional damage.

It is certainly less trouble for the engine crew to get an engine ready to go in under her own steam than it is to get her ready for tow. He demonstrates his ability as a man of proper qualification for the position he holds; and the power to haul the dead engine to the shops can be utilized to draw freight which, in turn, brings valuable returns to the company. Don't forget the company; from their exchequer comes the money that compensates you for the service rendered, be it good, bad or indifferent, but make up your mind to have the former take precedence.

Occasionally a fellow will say, "Well, don't you think it advisable to take down the main rod on the disabled side, and cover the ports and try and get her in in that way?" Well, to tell you the truth, I see you have not sufficient confidence in your ability to successfully handle the machine under the circumstances. But, instead of taking down the main rod on disabled side, remove the forward cylinder head instead; disconnect valve rod and cover ports. The cylinder head can be handled easier than the main rod, and this keeps a more even balance in the machine itself, making it easier on the rails, the cylinder can be lubricated by an occasional quantity of oil on the walls of cylinder through the open rod.

A goodly number of our young men coming up for promotion from firing to running the locomotive have been asking this question. Of course, it is no ordinary one, and requires more or less thought on the part of the man going in for the examination. Examiners have peculiar ideas of such questions as the above; but the most impartial accords the honors to the men giving the most intelligent answers.

Another question coming up recently for discussion among firemen for promotion is, as to the removal of the main rod in cases of disablement. The greater number of them feel as though the rod could be disconnected at the crank pin and allowed to lie on a small block on the bottom guide bar. But this cannot always be done with the modern build of locomotive. It may be noticed that with a locomotive of modern build there is no collar on the main crank pin as between the main connection side rod and butt end main rod brass, and if the main rod is disconnected and allowed to rest on the lower guide bar a block will have to be applied to the crank pin to hold main connection brass in its place, and in all probability this block would not clear the butt end of the main rod. From a practical viewpoint this is not the best course to pursue. Instead I could recommended to leave the rod connected and remove the forward cylinder head; the cylinder can be lubricated as in the previous case, thus saving labor to the engine crew with the disabled engine in removing the rod, and also saving the shop force in replacing the rod, and having to replace the liners, etc.

The locomotive engineer in these later days who keeps his ready reckoner under his hat is the fellow that is heard of the least while getting over the road, and makes the best average time for the 365 days each year—a pleasure to himself and a money-maker for the company employing him.

JAS. SPELLEN.

Large 2-8-0 for the B., R. & P.

The Buffalo, Rochester & Pittsburgh Railway purchased not long ago some heavy consolidation type engines from the American Locomotive Company. These 2-8-0 machines were built in the Dunkirk shops of the company.

The engines are simple with 21x28 in. cylinders, 57 in. driving wheels, and the calculated tractive power is about 38,600 lbs. The rigid wheel base is 15 ft. 9 ins., while the total for the engine alone is 24 ft. 6 ins. The total weight of the engine in working order is 186,000 lbs., and out of this, the driving wheels carry 166,000 lbs., thus 20,000 lbs. weight rests on the pony wheels.

The main drivers are the third pair, thus giving a long connecting rod. The eccentrics are carried on the main driving axle and direct motion actuates the piston valves. The valves have a travel of 5⅜ ins. and the lap on the steam side amounts to 1 in. All the wheels under this engine are flanged, and the equalizing is arranged so that the pony and the first pair of drivers are equlized together and the three remaining pairs of drivers are equalized together with springs between the frame bars while driving box equalizers connect them. The side rods are flat, solid bars of heavier section in the middle, and they are jointed in front of the crank pin of the second pair and behind the main crank pin. The connecting rod is of I-section.

The boiler is an extended wagon top one with the second as the taper course. The first ring is 70 1/16 ins. diameter, showing that the boiler is of large capacity. A pressure of 210 lbs. per square inch is carried, and there are 354 tubes 2 ins. in diameter and 14 ft. 6⅜ ins. long. These tubes furnish 2,672.7 sq. ft. of heating surface, and with the 175.8 of the fire box, the total comes up to 2,848½ sq. ft. The grate area is 54.43 sq. ft. The fire box extends out over the wheels, being 74 ins. wide. It is 108 ins. long.

The tender frame is made of 13-in. channels. The tank with its water bottom will hold 6,000 U. S. gallons, and 12 tons of coal. The total wheel base of engine and tender is 51 ft. 6 ins. and the total weight of engine and tender is 311,000 lbs. A few of the principal dimensions are appended for reference as follows:

Axles—Driving journals, main, 9½x11 ins.; others, 8½x11 ins.; engine truck journals, diameter, 6 ins.; length, 12 ins.; tender truck journals, diameter, 5 ins.; length, 9 ins.

Fire Box—Thickness of crown, ⅜ in.; tube, ⅝ in.; sides, ⅜ in.; back, ⅜ in.; water space, front, 4 ins.; sides, 4 ins.; back, 4 ins.

Crown Staying—Radial, 1 in.

Engine Truck—Swiveling and swing.

Piston—Rod diameter, 4 ins.; piston packing, snap rings.

Wheels—Engine truck, diameter, 30½ ins.; tender truck, diameter, 33 ins.

HEAVY 2-8-0 BUFFALO, ROCHESTER & PITTSBURGH

F. T. Hyndman, Superintendent of Motive Power. American Locomotive Company, Builders.

The Union Pacific people are experimenting with gasoline motors for use on the branch lines in the sparsely populated regions of Nebraska and Kansas.

A Wonderful Gas Locomotive.

A story comes to us by the way of Chicago of a wonderful gas locomotive, ordered by the Southern Pacific Company, which is reported to be capable of running three thousand miles without stopping, at the rate of 100 miles an hour or more. The motive power is a four-cycle gas engine possessing some valuable peculiarities that no other engine possesses. We fear that the promises on which this engine was built are figments of a fertile imagination, accustomed more to air and wind than to the substantial materials employed in building even gas engines. Some of the advocates of gas engines for high-speed transportation appear to be capable of rivaling electrical advocates, when boasting of what they will do. Our readers will soon learn particulars when the Southern Pacific deserts the old reliable steam locomotive for strange substitutes of unknown virtue.

Timely Assistance Appreciated.

Some time ago the Boston & Maine were unfortunate enough to have a serious accident to their Sunrise Express, and very effective help was rendered to the injured by the students of the New Hampshire College.

Mr. Lucius Tuttle, president of the B. & M., has acknowledged the obligation his road was under in a very gracious and substantial manner. He recently sent a check for $1,000 to President Gibbs, of the college, to add to the fund of the students' societies, and to be otherwise disposed of for the benefit of the boys as Mr. Gibbs may see fit. The letter accompanying the check expressed the high appreciation in which the valuable services of the college staff and students are held by the railroad officials.

How Engineers Find Bearings In a Fog

"When I was a guard," said Mr. Richard Bell, M.P., recently, "I could sit in my van with my eyes shut and tell where the train was at any moment. Working one section continuously one gets to learn the rhythmic song of the road and how it varies at each signal box, station, curve, gradient, tunnel and bridge.

"The sixth sense, which is more than mere hearing, is of the utmost value to a driver during fog. Denied the use of his eyes, he still does not 'lose his way' when he is on a familiar road.

"A driver cannot learn a new road when he is stoking, which should occupy all his time. He should always be allowed to travel as third man on the footplate, unfettered by work, and in two or three days, by keeping his eyes and ears open, he would learn the road." —London *Daily Mail.*

Power Plant Equipments.

The Westinghouse Electric & Manufacturing Company are building for the People's Power Company, of Moline, Ill., two engine type generators to be installed in their power station. The company is an old one in that section of the country, and has built up an extensive business in lighting and power work. The addition to their present equipment will be a 1,100 kilowatt, 2-phase alternator of the revolving field type, operating at 2,400 and 4,800 volts, and a 600 kilowatt, 600 volt, direct-current machine. The alternating current generator is a duplicate of a machine which the company put into service about a year ago.

An order for three 300 kilowatt, alternating current generators has also been placed with the Westinghouse Company by the Barber Lumber Company, of Boise, Idaho. These machines will generate current at 440 volts, which will be transformed to 23,000 volts for transmission. The necessary transformers, switchboards and lightning arresters are included in the apparatus to be furnished.

Railway Travel in France.

On the principal railways of France the traveler finds his train keeping to the left hand set of rails. This is what he is used to in England; but when he emerges from the station and takes a tram car or cab he finds his vehicle and all others inclining to the right. When he comes into Germany he finds trains rigidly keeping to the right like road vehicles. Why is the difference, asks an English traveler. In France the railway was not developed from the colliery tramway as this had been from the plank road, but was imported from England, and with it the left-hand direction. Once settled the railways have stayed so —with a flavor of the exotic about them still.—*N. Y. Globe.*

Collision on Track Protected by Block Signals.

A tail-end collision on a track protected by block signals is something that calls for explanations. Among the records of recent railway accidents we find that a mail train consisting of a locomotive and two cars, on the New York, New Haven & Hartford Railroad smashed into the rear of a freight train near Milford, Conn., doing considerable damage. Among railroad men, after the wreck, there was a difference of opinion as to whether the mail train ran by a block signal set against it or whether the signal failed to work properly. It was said that the cautionary signal had not been in perfect order lately.

A block signal not in perfect order is worse than useless and invites disaster, but to the well-trained engineer a signal out of order means a notice to stop.

Railway Train on Dinner Table.

When Andrew Carnegie was a guest at a "steel" dinner not long ago, miniature crucibles and implements used in engineering works were utilized during the service of the meal both as practical aids and as appropriate ornaments.

England has added a few features to odd dinners, which surpasses anything done in America. Messrs. Armstrong, Whitworth & Co. have built a small train especially for a millionaire, to take around decanters and cigars after dinner.

The little engine, over which two dolls in blue overalls preside, is constructed of silver-plated copper in miniature reproduction of a Great Western locomotive. The tender is stacked with coal from the millionaire's own coal mine.

When the millionaire touches a button the train starts. It runs quite slowly round the track, and when a guest picks up a decanter the current is broken, and the train stops till he replaces it. The total length of the train, which is driven by electricity, is more than five feet, and the track is constructed for a twenty-foot table.—London *Express.*

New Santa Fe Equipment.

An order for some new equipment was placed the other day by the Santa Fe. It comprises 75 locomotives, 5,300 freight cars and 60 passenger coaches, and postal cars, all to be delivered within the next four months. Fifteen of the new engines are Atlantic type balanced compounds, thirty Pacific type balanced compounds, and thirty Santa Fe type. This big expense, aggregating more than $5,000,000, is incurred in order that growing traffic may be promptly handled.

The annual convention of the International Master Boilermakers' Association will be held in the city of Buffalo, beginning May 16 next. The Hotel Brozel has been chosen as headquarters. Messrs. E. J. Hennesy and J. McAlister are in charge of the arrangements.

It is reported that negotiations are pending between the Chesapeake & Ohio and the Baltimore & Ohio for the acquisition by the former of the Valley, which will thereafter be operated exclusively by the Chesapeake & Ohio. The people of Staunton, Va., do not take kindly to the plan.

Renumbering on the Pennsylvania.

The Pennsylvania has arranged a a scheme of renumbering their freight cars by which certain blocks of numbers will be assigned to certain classes of cars, so hat when a car number is given those concerned will be able to know from the number whether the car is a box, a flat, or a gondola, and whether made of steel or of wood or of steel and wood combined. The freight cars will run from 1 to 999999. The eastern end has from 1 to 500000 and Lines West from 500000 to 999999. In these ranges of numbers different classes will have certain blocks of figures assigned so that a car number given, it will, for example, be at once possible to say that car is a high-side steel hopper gondola, belonging to Lines West. The numbering of the enormous freight equipment of this road will probably occupy about a year.

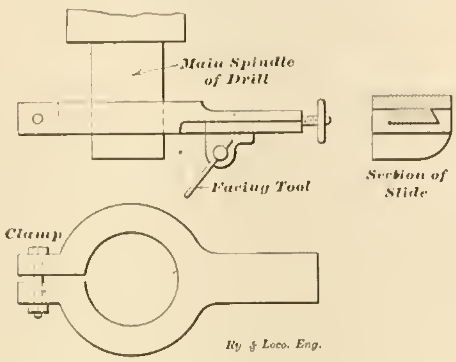
The Locomotive Publishing Company, Ltd., of 3, Amen Corner, Paternoster Row, London, have recently issued a locomotive chart on the same lines as our transparency of the famous Engine 999 and our Educational Chart No. 7, which is a reproduction of a modern Pennsylvania Lines 4-4-2 engine. The transparency got out by our English contemporary is on plate paper and is 20x13 ins. in size. It represents an up-to-date British Atlantic type express engine with every detail numbered and named. Price, one shilling, or, post free in roller to prevent crushing, one shilling and three pence, or, as our cousins across the water would say, "one and three." We do not handle this chart, so that those of our readers who would like to have one should write direct, using the address given above.

There is an impression among many railway men that roller bearings while theoretically offering a minimum of frictional journal resistance were not practicable under the shocks and jars of car operating. We find, however, that roller bearings are quite common in street car service and now the Toledo, Bowling Green & Southern Traction Company, that operate long distances, have decided to equip all their cars with roller bearings.

Rudyard Kipling has, of course, done more to familiarize the world with India than anyone else. Here is an incident which Mr. Kipling tells as an actual event, which has somehow escaped finding its way into any of his books. A few years ago the native station master of an Indian railway station many miles from any city was attacked by a tiger made bold by hunger. His assistant instantly took refuge in the office, barricaded the doors and wired for instructions to the nearest town. Imagine the amazement of the operator at the other end of the line to receive the following dispatch: "Tiger on platform eating station master. Please wire instructions."

Facing Attachment for a Drill Press.

By an easily applied and easily removed shop appliance, a drill press in the Buffalo, Rochester & Pittsburgh



FACING TOOL ATTACHMENT FOR ORDINARY DRILL PRESS.

Railway plant at McKees Rocks, Pa., can be made to face off the ends of driving brasses and do other jobs of a similar kind. Our illustration shows what is really a clamp fitted on the main spindle of a drill press and tightly held there. The clamp device has a tool holder and slide on the other side. The clamp is sufficiently deep to take firm hold and it stands with arm at right angles to the spindle when tightened up.

The clamp device with slide and tool revolves with the motion of the drill press spindle and at each revolution the operator in charge gives the hand wheel on the end of the slide a turn and so advances the tool for another cut. This is, of course, done without stopping the machine, and the drill press can often be put upon this and similar work when it would otherwise be standing idle.

A press dispatch from Tulsa, I. T., says that the St. Louis & San Francisco are getting ready to experiment with the oil of the Tulsa district for locomotive fuel, and are equipping a number of their engines as oil burners. Tests of the oil have been made which show it to be of superior quality as a fuel. It is said that the base of the Tulsa oil makes the very best kind of steam fuel.

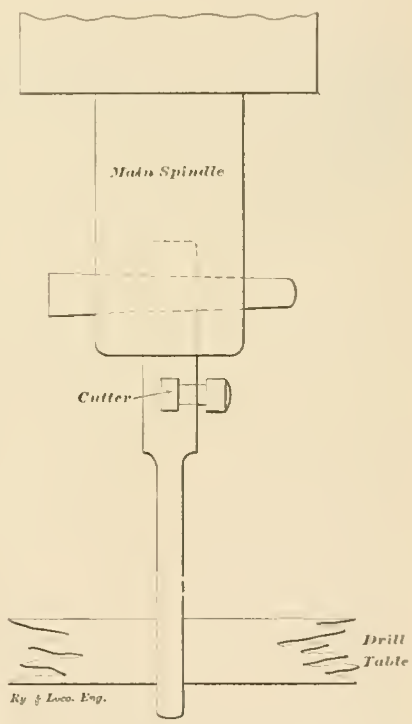
The working force of the Baldwin Locomotive Works has been increased to 13,500 men. A night turn of about 5,000 men keeps the plant in operation from nightfall to daylight.

Enlarged Scope of a Drill Press.

A handy rig which, if you like, you may call a boring mill attachment, is used when occasion requires on an ordinary drill press in the McKees Rocks shops of the Pittsburgh & Lake Erie Railroad.

The main spindle of the drill press has a key-way cut clear through the socket for the drill, and what may be called a cutter bar is made to fit the socket in the main spindle, and this cutter bar has also a key-way which when in position registers with the one through the main spindle.

The upright cutter-bar, as we have called it, passes through a hole in the table of the drill press, and as it is a neat fit a very effective guide is thus secured. In the upper enlarged head of the cutter-bar an oblong hole is cut which carries the tool. This device is useful for facing off or boring when that kind of work comes along, and with the assistance of this home-made rig, the drill press turns in and lends a hand at the kind of work it was not originally designed for. The drill press is not a particularly new one, but its



BORING ATTACHMENT FOR ORDINARY DRILL PRESS.

scope of operations has thus been enlarged and it bids fair to hold its own with other tools for some time to come.

Pneumatic hammers were recently introduced into the boiler shop of the Cooke Locomotive Works, at Paterson, N. J., and the local papers have had gushing articles describing the ingenious novelty.

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The Promise of Steam Superheaters.

For a few years after locomotives were introduced the designers and promoters devoted themselves principally to the production of an engine that could be depended upon to start with a train and take it to the terminus without failure. Reliability was of the first consideration, just as the same sentiment dominates the operating of automobiles to-day. When the time came that a locomotive could be depended upon to do its work with certainty, rain or shine, considerations of economy began to intervene, and they have been in evidence ever since. At first the quantity of steam necessary for each horse power of work was regarded as of secondary importance; the amount of fuel required to generate a cubic foot of steam was not thought to be worthy of serious attention, but time, experience and familiarity with the practice of power production gradually changed all that. The information brought to us by memory, reading and observation leaves the impression that about every ten years there is an agitation in favor of some new and saving grace, that is going to make the locomotive less wasteful of heat. The agitations have been something like religious revivals—periodic and keenly infectious. We will not embarrass people who may have been among the disappointed by enumerating the panaceas that have failed. Improvers, looking for something new, have frequently been in the position of Byron when he exclaimed:

"I want a hero, an uncommon want,
When every month and year bring forth a new one,
Till after cloying the gazettes with cant,
The age discovers he was not the true one."

The last period of revival brought forth the compound locomotive; the present time of travail is wrestling over steam superheaters. As in religious revivals, the days of backsliding leave some seeds that bring forth fruits meet for repentance; so with every agitation for locomotive improvement some benefit remains that the backsliding did not carry away. On this account we welcome the movement to save coal by superheating the steam.

When James Watt, the celebrated inventor, first directed his fertile mind to the problem of converting the energy of fuel into work through the medium of boiled water, he followed the practical study through the operation of an atmospheric engine, in which the steam used was condensed inside of the working cylinder to produce a vacuum. Watt had studied the various manifestations of heat very deeply, before he began experimenting with the steam engine, and he soon discovered that the practice of cooling the cylinder during each stroke was responsible for immense waste of heat, thence of fuel and power. As his experience progressed he came to the decision that to make a steam engine work within the range of practical economy it was necessary to maintain the cylinder as hot as the steam that entered it. That led to the invention of steam jackets and other provisions against chilling of the steam used in the cylinder to perform work; but none of the inventions contrived for this purpose proved satisfactory, and it was left for Watt's successor to wrestle with the problem of preventing the steam in the cylinder from condensing before exerting its energy. Keep the cylinder as hot as the incoming steam was Watt's famous injunction. He did not succeed in doing it himself, but he impressed upon succeeding generations of engineers the high importance of preventing cylinder condensation. A lesson which experience and much misdirected effort brought was that there is no practicable way of keeping a cylinder as hot as the steam that comes from the boiler, and that other means must be resorted to as a preventative of initial condensation.

We do not remember of any improvement on the steam engine tried so persistently as inventions intended to prevent cylinder condensation. The first line of invention was in the shape of steam jackets, which were produced in a great variety of forms. Some of them worked fairly well, but others, instead of acting as heaters, were veritable condensers that wasted a large part of the incoming steam by the volume of cold water left in them through faulty design or defective drainage.

We might explain for the benefit of our young readers that steam jacketing consists of heating the cylinders by passing hot steam from the boiler into an annular space cast round the outside of the cylinder barrel and into the cylinder heads, both of which are made hollow. Some inventors, whose efforts are known even to young readers, have been foolish enough to pass exhaust steam through these jacket spaces, and the exhaust steam, being colder than the incoming steam, acted as a condensing medium.

The admitted waste in the cylinders through steam condensation led to the introduction of compound engines, in which the range of temperature in two or more cylinders was much smaller than in a single cylinder where steam was used expansively. This effected some improvements, but it still left much to be desired in an engine that seldom converts into work more than one-tenth of the potential energy in the fuel used.

With all the most improved mechanical appliances in use to make the steam that passes from the boiler perform a maximum of work, there still remains immense waste of heat and a large proportion of the waste arises from the steam turning into water before it has the opportunity to perform the work of pushing the piston. As saturated steam is always at the dew point, ready to become water at the least loss of heat, that process of condensation is constantly going on in the working of a steam engine, and the loss is seldom less than 25 per cent. Compounding and steam jacketing help to some extent, but for locomotives their benefit has not been much to boast about, especially steam jacketing, which has generally caused more loss than gain.

As soon as engineers and scientists began to realize that wasteful condensation occurred while steam was doing its work in driving an engine, it was natural that investigations should be conducted with the possibility of putting extra heat into the steam that would hold it above the dew point until its work was done. That such a thing could be done was soon demonstrated, and the process was for years known as surcharging steam. Various processes were employed to produce superheating of the steam, and the practice became recognized as a promising method of effecting heat economy. In 1857 the steamer "Valetta" was equipped with a superheater and the effects carefully recorded. A steam saving of 20 per cent. was effected, the boiler pressure being 20 pounds to the square inch, a low temperature that maintained increase of heat without involving trouble with the lubricants.

After the experience with the "Valetta" superheating became very common in connection with marine engines and has worked quite satisfactorily. The best results have been obtained by passing the steam, on its way from the boiler to the cylinders, through a series of tubes placed across the uptake of the boiler, which is nearly equivalent to placing a similar device in the smoke box of a locomotive. The superheater is most efficient for boilers that have a tendency to prime or to entrain water with the steam, for it generally evaporates that water.

The introduction of superheaters has been hindered by the use of lubricants that were destroyed by the heat. The use of mineral oils has mitigated that evil, and experience in lubricating gas engines has brought useful knowledge that is overcoming the difficulties in using steam of abnormally high temperature.

The ideal conditions of superheating steam is to raise the temperature sufficiently to prevent condensation during expansion and exhaust. Should the superheating be in excess of that amount the steam will not begin to condense until it has passed out of the cylinder. If the degree of superheating be insufficient to keep the steam from liquefaction, benefit will be derived in proportion to the amount of extra heat imparted.

Several of our railway companies are experimenting with superheaters on their locomotives, and others are sitting on the fence waiting for more light. The Schmidt superheater, which has been successfully applied to fifty or more locomotives belonging to the Prussian State Railways, is on the American market, and it has a rival in this country in a superheater designed by Mr. F. J. Cole, of the American Locomotive Company. The likelihood is that a great many locomotives will be equipped with one of these superheaters in the near future, and if they prove popular a fertile crop of new ones may be expected from our inventors.

There are obvious objections to placing in the smoke box of a locomotive the mass of tubes necessary to impart extra heat to the great volume of steam used by a locomotive doing hard work. The experience in trying to superheat the low pressure steam of cross compound locomotives does not offer much encouragement to those who purpose superheating the steam passing direct from the boiler. The temperature of steam at 200 pounds gauge pressure is 387 degrees Fah., which does not give the smoke box gases a great margin to act upon. Steam absorbs heat very reluctantly, especially after it becomes a perfect gas, which happens with less than 20 degrees Fah. of superheating. Thurston mentions a case where 500 degrees Fah. was required to give 50 degrees superheating at the exhaust, and that 100 Fah. has usually been considered a practical maximum superheat. If the experimenters with locomotive superheaters can obtain one-quarter of that extra heat they will do remarkably well, and their apparatus may prove the most valuable improvement applied to railway motive power in many years. We are moved, however, to caution our railway friends against building up high hopes on the reduction of operating expenses to be achieved by the use of steam superheaters.

The Interborough Strike.

A fundamental rule of the Brotherhood of Locomotive Engineers is that the organization will not support a strike of the members until the grand officers have exhausted their efforts to secure a peaceful settlement of grievances or of any difficulty that may arise between members and their employees. There has been for some months agitation going on among the motormen of the Interborough lines of New York against the company for reputed grievance, the discontentment having been voiced by Jencks, chief of division 105 of the Brotherhood of Locomotive Engineers, the members of that division having become motormen when the change was made from steam to electricity, at their old pay of $3.50 a day. On March 7, at the instigation of Jencks, the motormen went out on strike without consulting with the heads of the Brotherhood. The company employed other men and the strikers were beaten, but their action caused great inconvenience to the people of New York, who are dependent upon the elevated and subway lines for transportation, and there was very decided public sentiment against the strikers.

Grand Chief Stone of the Brotherhood of Locomotive Engineers visited New York several days after it had commenced and investigated the strike. On returning to the headquarters at Cleveland he called a meeting of the Grand Officers, and they demanded the withdrawal of the charter of subdivision 105 and ordered the members to return to work. As these men were working under a three years' contract begun last September which had been violated, they had thrown themselves out of employment, with no influence to help their reinstatement. The likelihood is that most of them will be taken back, but it will be as new men with reduced pay. Most of the men went out like sheep to the slaughter without having any idea that they were violating the rules of their brotherhood.

Inspection and Repairs to Cars at Outside Terminals.

The committee of the North-West Railway Club, who have been instructed to investigate the method of doing inspection and car repairs at outside terminals, do not mince matters when they say in presenting their report, "The inspection of cars at outside terminals is neglected on all the roads."

That is a strong statement, but anyone reading the report carefully will be inclined to believe that it is true. They say this state of affairs is due to several causes, among which are the lack of adequate time for the inspection of trains, owing to the operating officials being desirous of getting trains over the road with the least delay. This is made worse by the employment of insufficient help, due to ideas of economy entertained by motive power officers and to the class of help so occupied.

The committee believes that more time is ultimately lost through poor inspection than is gained by rushing things through. As an example they point to the effect of insufficient time for inspection on a train where journal boxes need attention. When rushed along hot boxes result, and that and loss of time go together, and more expense is incurred in the long run. Defective draw gear, not repaired for lack of time, means road failures and time lost and expense produced, due to chaining up, or the direct damage of a break-in-two.

Insufficient help is the cry at almost all outside terminals or car interchange points, and necessary work is "slighted," as the men call it. The low grade of inspectors often employed increases the trouble. Where very little help is employed it should be of first-class quality. The man or men at such points should be a good combination of coach cleaner, car inspector and repairer.

Not only does the poorly equipped outside station run up expense which must be paid for by the issuance of defect cards, and delay at the foreign delivery point, but it reacts on the central repair points by causing more work to be done there by the reception of defective cars, which grow worse in the trip from the outlying to the central repair point, and when once accepted preclude the collection of indemnity by reason of the absence of defect cards which should have been demanded at the frontier points. The augmented repairs at central stations still further increase the congestion of traffic and the delay to freight.

When it comes to passenger cars, much annoyance is caused to operating and mechanical department officials because coaches on outside runs, where they do not get into regular cleaning terminals, are seldom properly cleaned or cared for. Men without sufficient time to do the work and often without proper training are the primary cause of the trouble. The committee sums up the needs of the outside terminal briefly as they close their plain spoken report by saying that such repair stations require, first, sufficient time to make good inspection; second, sufficient time to fully make the necessary inspection; and third, experienced men to do the work, plus modern facilities for accomplishing the same.

Minimum Thickness of Driving Tires.

An important factor to be taken into consideration when locomotive driving tires become thin and work loose is that the brake power of the train is considerably reduced. This point was recently brought out by Mr. G. H. Horton, of the Soo Line, when addressing the members of the North-West Railway Club. When a tire becomes loose it is necessary to cut out the driver brake on some trains. This is a most serious subtraction from the available stopping power. These remarks apply to a short train as well as a long one.

The subject of the minimum thickness of driving tires applied to locomotives for safety and economy has been considered in some way by the mechanical department on all railroads. The speaker cited the experience of his road by saying that tires turned over to less than two inches often result in a broken wheel center, which is expensive to replace. In every case but one the wheel center was made of cast iron, but the expense was the same as the cast iron when replaced by steel. The only exception was that of a ten-wheel passenger engine with a 66 in. steel driving center, having 96,000 lbs. on the drivers. The last turning left the tires 1⅝ ins. thick, and the engine had only run a short time with these tires when three spokes in one wheel broke.

The speaker quoted some data given him by Mr. Geo. H. Emerson, superintendent of motive power of the Great Northern Railroad. On that system engines with 120,000 lbs. and over, on the drivers, have the driving tires removed when they will not turn up to exceed 2 ins., and these tires are made use of on lighter power. The same practice prevails with freight as well as passenger engines. There are on the Great Northern four sizes of wheel centers in use, viz., 42 ins. for switchers, 48 ins. for freight, 56 ins. for local passenger and 66 ins. for heavy passenger power. Trouble is experienced with 66 in. tires when they are less than 1¾ ins. thick and nothing less is applied to these engines. On the other three sizes, tires are not permitted to go below 1⅜ ins. By the transfer of the tires from the heavier to the lighter class of power, the tires can be worn to the limit.

The cost of removing tires depends largely on the style of heater used and on the class of labor employed to do the work. The Great Northern appear to have obtained the best results from a crude oil heater. It takes about 30 minutes to heat and put on a tire. The men who do this work are what one would call handy men and helpers who get about $1.75 per day.

The information furnished by Mr. Benjamin, master mechanic of the Chicago & Northwestern, to the speaker, was to the effect that the C. & N. W. considers 2 ins. the minimum safe thickness for passenger engines and 1⅞ ins. the minimum for freight engines without reference to whether the power is heavy or light or whether the wheel centers are large or small. The cost of changing the tires of an eight-wheel engine is $13.50, and the cost of shiming up one tire $1.75.

Mr. Maine, master mechanic of the Chicago, Milwaukee & St. Paul, was quoted as saying that on his road the minimum safe thickness of tires for large engines is 1-13/16 ins. and 1-5/16 for light engines. Passenger and freight engines are treated alike and large and small wheel centers receive the same treatment. Mr. Maine gave the cost of changing tires on an eight-wheel engine on his road as $4.24 when in the shop for repairs, and the cost of shiming up one tire as 53 cents.

The opinion of Mr. Hunt, assistant mechanical superintendent of the Erie, was given by the speaker. Tires for heavy engines should not be turned to less than 2 ins., and for light engines the tires should not go below 1¾ ins. The experience of the Erie is that better material is usually found when 3 in. tires are bought in preference to 3½ in. tires. They find that as a 3½ in. tire is turned down the material is softer, and wear is faster and they flatten quicker than 3 in. tires under the same conditions.

Book Reviews.

Cyclopedia of Applied Electricity, Prepared by a Corps of Experts, Electrical Engineers and Designers. Publishers: American School of Correspondence, at the Armour Institute of Technology, Chicago. 1905. Price, $18.00.

This work is published in five volumes and contains about 2,500 pages and has over 3,000 illustrations. The book appeals to electricians, engineers, telephone and telegraph operators, engineering students, and to any person who uses electricity for any purpose. It is not addressed to the technically educated specialist and the explanations and descriptions have been made as simple as possible. Higher mathematics have not been employed.

The five volumes of which the cyclopedia is composed have been written with the object of producing thoroughly modern text-books on the subject, and for this reason great care has been taken to select practical examples, and each volume contains a list of review questions which are intended to assist the student in testing his knowledge of the subject as he goes along. There is a subject index contained in the fifth volume.

Part I takes up the elements of electricity and magnetism and contains illustrations and explanations of the laws which govern their various manifestations. Electrical wiring and kindred matters follow, these are succeeded in turn by a chapter on the electric telegraph and all matters connected with telegraphy in its various forms. Part II takes up the dynamo and electric generators, etc. The second section of this division is concerned with the different types of direct current generators as made by leading American firms. Electric motors in shops has a chapter to itself. Part III is devoted to electric lighting, electric railways and the operation of electric machinery and to power station design. Power supply and distribution is the next general division of the subject which is followed by a chapter on management of dynamo-electric machinery, and one on power stations. Part IV discusses very fully alternating currents and automatic current machinery and allied subjects. Part V deals with the telephone. Sound is first taken up, then comes primary and storage batteries. Open-line work is considered, the placing of overhead wires and cables, switchboards and details connected therewith, maintenance, with an analysis of the duties of each part of the working force of a telephone system. The automatic telephone system is also explained and illustrated. The entire work forms a valuable addition to the library of any student in the wide field of applied electricity.

Elements of Mechanics, by Mansfield Merriman. Publishers: John Wiley and Sons. New York, 1905. Price, $1.00.

This book is written by the professor of civil engineering in Lehigh University and is practically forty lessons for beginners in engineering. It contains 172 pages and is illustrated with about 142 line drawings or diagrams. The book is divided into seven chapters, dealing respectively with concurrent forces, parallel forces, center of gravity, resistance and work, simple machines, gravity and motion and inertia and rotation. There is an appendix containing answers to problems, trigonometrical functions, and an index. Each of the chapters is divided into five or more sections dealing with matters which are logically related to the subjects forming the captions of the chapters.

We are told in the preface that "to read this volume with interest and profit only a knowledge of plain geometry, elementary algebra and plain trigonometry is required. It is intended for manual training schools, freshman classes in engineering colleges and for young men in general who have the preparation just indicated."

Locomotive Injectors, by "The Inspector." Published by the Locomotive Publishing Company, Limited, London. 1905. Price, $1.00.

This book is 7¾x5 ins. and contains 56 pages. It is clearly illustrated throughout and is intended as a handbook on the theory and application of injectors with hints on repairs and management and historical notes.

The book has been written for locomotive men and stationary boiler attendants. The subject is treated without the use of mathematics, easily understood arithmetic only has been used. The first chapter is on the theory of the injector. The second is on the different types of injectors, selection, management and repairs, Chapter three contains some interesting historical notes.

International Railway Congress.

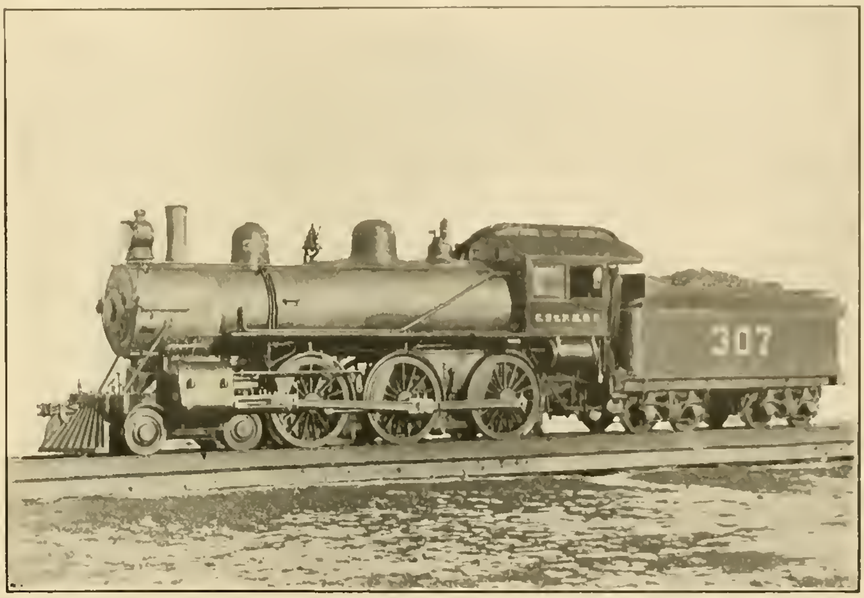
It is expected that more than 650 railroad presidents, managers and manufacturers of railroad appliances will be present at the meeting of the International Congress to be held in the city of Washington, D. C., from May 3 to the 14th. That number have already signified their intention of being present. A committee composed of Col. W. St. John, chairman, and Messrs. Geo. S. Fowler, B. F. Pilsen, N. C. Dean and W. R. Gravenet have been appointed a Washington bureau to look after the railroad appliances men who may come. Three meetings are to be held daily in the two banquet halls of the New Willard and the Raleigh to discuss problems of interest to railway men. It is the first time that this congress has ever met in the United States, and the indications are that it will be one of the best meetings ever held.

May Railway Conventions.

Several railway conventions will be held in the month of May. May 3 heads the list with the International Railway Congress at Washington, D. C. May 16 the International Railway Boilermakers' Association meets at Buffalo. On May 17 the Association of Railway Telegraph Superintendents meets at Chattanooga, Tenn.; also on the same date the Freight Claim Association meets in Philadelphia, and on May 22 the Railway Storekeepers' Association meets in Chicago.

An educational chart of a modern boiler room has just been published by the Norman W. Henley Publishing Company, of New York. It is a clearly and very accurately drawn view of the interior and shows in isometric perspective all the mechanisms which are found in such a place. The equipment consists of water tube boilers, ordinary grates, mechanical stokers, feed water heaters and pumps. The various parts and appliances are exhibited as broken or with parts removed so that the internal construction is fully revealed. Each part is numbered and the name is printed in the margin. The chart is printed on plate paper and is about 24x14 ins., suitable for framing. It is the work of Mr. Geo. L. Fowler, of New York, and is worth the price, 25 cents. It shows what a thoroughly clean, tidy boiler shop looks like, and may, therefore, be a novelty to some steam users on that account. The chart can be procured at this office.

An Assemblyman has introduced a bill into the New York legislature providing that every railroad corporation shall make a quarterly inspection of all locomotive boilers, under a penalty of $100 for each violation. The bill further provides for the appointment of a State inspector of locomotive boilers by the railroad committee at a salary of $3,000. This bill has no chance of becoming a law at present, but it represents a growing sentiment in favor of better supervision of locomotive boilers which will cause legislative action, if boiler explosions continue to be so numerous.



A HARD WORKER FOR THE C., ST P., M. & O

The result of the letter ballot sent out for the next place of meeting of the Traveling Engineers' Association resulted in Detroit, Mich., getting the majority of all the ballots cast. The president of the association has appointed the following gentlemen on the committee of arrangements for the next annual meeting, viz., Messrs. David Meadows, Chairman, A. D. Homard, W. T. Simpson, R. E. Webb, John McManamy. The meeting will take place in September.

The North British Locomotive Co. recently secured an order for eighteen locomotives from the Japanese government. They will be built at the Hyde Park works, Springburn, Glasgow, Scotland.

Injunction Against Expulsion of a Brotherhood Man.

The appellate division of the Circuit Court, sitting at Schenectady, N. Y., last month rendered a decision of unusual interest to Brotherhood men; it was that of Alden W. Young, respondent, against Maurice Barry, as Chief Engineer, subdivision 152 of the Brotherhood of Locomotive Engineers.

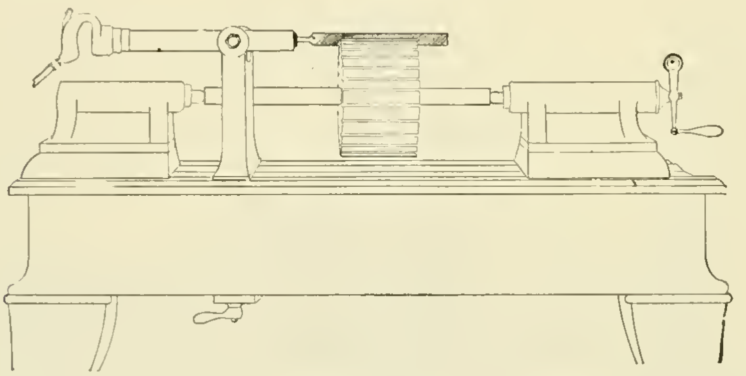
The plaintiff lives in Oswego and was adjudged guilty of violating one of the Brotherhood's rules in writing to the superintendent of the motive power department of a railroad, suggesting assignment of certain "runs" to engineers on the Northern division. Refusing to be disciplined without being heard he took the matter into the courts, where the defendent union official was enjoined, as were all members of subdivision 152, from troubling or expelling him. In this decision the court unanimously continues the injunction.

Quick Filing by Air.

A novel and very useful method of using one of the Chicago Pneumatic Company's sand rammers is shown in our illustration. The sand rammer is usually employed in the foundry and is for all practical purposes a good-sized pneumatic hammer.

In the illustration which we show, a spindle is placed in a lathe from which the turning mechanism has been removed, and on this spindle is keyed the armature of an electric motor. The sand rammer, which is a 1¼x7-in. pneumatic device, was used because of its length of stroke. It is pivoted in a holder clamped to the bed of the now dismantled lathe. It is balanced so that the file which it carries will feed into the slots by its own weight.

When the workman presses the button in the rammer handle the mechanism does the rest, and it is said to equal the performance of five good hand file men each day. There seems to be no reason to suppose that this rapid filing method should not have other applications to the work usually done in railroad shops, and the idea is commended to the consideration of our readers. Air filers for particular kinds of work may yet fill a long-felt want.



CHICAGO SAND RAMMER AS USED FOR FILING SLOTS IN ARMATURES.

Air Openings Under Locomotive Grates.

At a recent meeting of the North-Western Railway Club it was stated that as design follows design in modern locomotive building, the tendency is to reduce the damper openings, and that on some of the more recently built engines the damper opening was simply too small. Where this state of affairs exists there is a considerable loss of heat which means the very expensive burning of fuel.

The subject is certainly important and it has moved a well-known manufacturer of staybolts to here add his quota to the discussion of the subject which was started at the club meeting. He says:

"For perfect combustion it requires 8 lbs. of oxygen for every pound of hydrogen and 2⅔ lbs. of oxygen for every pound of carbon. With the dampers of a modern locomotive as now constructed, how is perfect combustion to be attained? By staying the fire box with hollow stays with an inside diameter of ⅛ in. and not over 3/16 in. You cannot get sufficient air through the grates and you dare not have the air in excessive volume over the fire bed, but to the extent that you can get air through 1,000 or more hollow staybolts with ⅛ in. holes, whether sufficient or not for perfect combustion, you will have enough oxygen by its union with the combustible gases in the fire box to pay for the hollow staybolts several times over. As the air passes through the hollow staybolts the risk of burning is decreased, expansion of the bolt is lessened and the cracking of the sheets from antagonism is made nil. Furthermore, the exhaust of the locomotive drawing a current of air through the hollow bolts keeps the hole open and thereby presents a double opportunity for the detection of breakage, both inside as well as outside of the fire box. The hollow bolt being rolled hollow, its strength is increased and it is uniform and the bolt is flexible."

Bordo Valves.

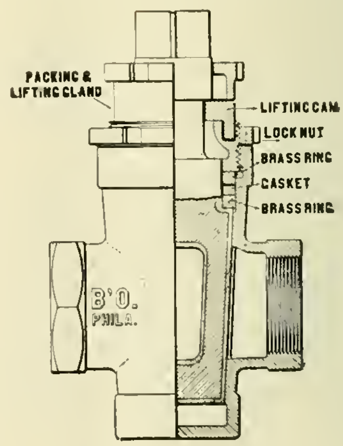
The Bordo valves are primarily intended as blow-off valves on boilers, where they have proved most effective and lasting. A casing of non-corrosive composition separates the plug from the body, which prevents the valve from sticking.

The valve is operated with a wrench on the square of the plug. The lifting gland when adjusted is permanently fixed by a lock-nut. By releasing lock-nut, and turning the gland to the left, the plug is lifted so that it can be made to turn easily at all times. When the lock-nut is moved up, a lifting cam, which couples the packing gland to the plug can be pulled out, and the gland is then free to be removed for repacking, which feature has been found to be very desirable when the locomotive blow-off needs repairs, and the work may be done in a very short time.

For locomotive blow-off the valve is made of new copper and tin only, in order to secure strength and durability, and very satisfactory results have been obtained.

Many railroads have tested this device within the past five years, and it has been adopted as standard on the largest railway system in the United States.

This fact should commend itself to



BORDO PLUG VALVE.

those experiencing trouble with leaky blow-off valves, caused by bad water or scale formation. In the Bordo locomotive plug valve this trouble has been obviated. The makers guarantee every locomotive blow-off valve by furnishing one for test, in order to prove their claims. Further information can be gained by addressing the L. J. Bordo Company, Philadelphia, Pa.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. When a student wishes to receive a private answer, he is reminded that it is usual to send a stamped envelope for the return letter. We will be glad to answer any question relating to railway matters, but prefer that they be suitable for our question and answer department. All letters intended for Our Correspondence School ought to be addressed to Department E.

This Month's Lesson.

We have taken up the subject of compound locomotives in this lesson, and it will be found that Mr. Baker has made the answers remarkably plain. Compound locomotives are not so much in evidence as they were a few years ago; but that form of engine has come to stay, and the engineman wishing to be abreast of the times, ought to give the lesson careful attention. Air brakes will be dealt with next and Mr. Nellis is preparing answers that will in themselves make a first class hand book on all points relating to air brake operating.

We are already receiving good accounts of the benefit that our educational course is bringing to men who have to pass the ordeal of an examination before being promoted. We caution all concerned against the tendency to delay study until the time for examination is approaching. Procrastination is the thief of time.

Questions and Answers on Compound Locomotives.

1. Wherein do compound locomotives differ from ordinary or simple engines? A.—Compound locomotives differ from the ordinary type in that a simple engine has but one set of cylinders of the same diameter and uses the steam but once, while a compound or double expansion engine has either two or four cylinders of varying diameters, and the steam, after passing through the first set and losing part of its energy, passes into the second set of cylinders, where a certain amount of its remaining energy is used.

(The difference between the two types would be plainer to the student if the first builders of compounds had used the phrase "double expansion" instead of "compound.")

2. Why is one cylinder on a compound locomotive called the high-pressure cylinder and the other one the low-pressure cylinder? A.—Because the high-pressure cylinder takes its steam directly from the boiler at nearly initial boiler pressure, while the low-pressure cylinder, under ordinary conditions, receives the steam from the high-pressure cylinder only and at a greatly reduced pressure.

3. What is the principal advantage claimed for compound locomotives? A.—Economy in the consumption of fuel and water. A compound engine in good order and properly operated does more work with a given volume of steam than a simple engine.

4. In the Schenectady two-cylinder compound what is the duty of the oil dash pot? A.—The duty of the oil dash pot in the Schenectady compound is to insure a steady movement of the valve without shock.

5. Is it necessary to know that the oil dash pot contains sufficient oil, and why? A.—The oil dash pot should be kept full of engine oil to prevent intercepting valve from slamming. Failure or breakage of intercepting valve can nearly always be traced to lack of oil in dash pot.

6. Explain how a Schenectady two-cylinder compound may be operated as a simple engine? A.—To operate the Schenectady compound (two-cylinder) as a simple engine, the handle of the three-way cock in the cab is moved by the engineer so as to admit either air or steam pressure into the pipe which connects with one end of the separate exhaust valve chamber, forcing the separate exhaust valve, which is otherwise held in normal position by a spring from right to left and in the direction of the intercepting valve. Then, as the throttle is opened, steam is admitted directly from the boiler into the passage which communicates with the intercepting valve, forcing the valve from left to right and permitting the steam to pass through it, and leaving it through suitable ports and passages, whence it passes through the reducing valve to the low-pressure steam chest. At the same time steam is admitted directly from the steam pipe to the high-pressure cylinder. Steam is exhausted directly from the high-pressure cylinder to the atmosphere through the receiver and separate exhaust passage, while steam from the low-pressure is exhausted directly to the atmosphere.

7. When should a Schenectady compound be operated as a simple engine? A.—Only at very slow speeds, when there is danger of stalling, and in starting very heavy trains.

8. Why not operate as simple when running faster? A.—Because it would mean not only a waste of steam and greater consumption of fuel, but also a greater and unnecessary wear and strain to the machinery.

9. Explain how the two-cylinder compound engine is changed from simple to compound? A.—To change a two-cylinder compound from simple to compound, the three-way cock would have to be returned to the normal position, which permits the pressure to be withdrawn from the piston head of the separate exhaust valve. As this pressure is exhausted to the atmosphere, the compressed spring is released and forces the separate exhaust valve to normal position, closing communication. The pressure in the receiver, due to the exhaust from the high-pressure cylinder, will rise and force the intercepting valve to the left, which opens the passage for the exhaust steam from the high-pressure cylinder through the receiver to the low-pressure steam chest. The movement of the intercepting valve to the left shuts off the live steam between the boiler and the low-pressure steam chest.

10. What moves the intercepting valve in a two-cylinder compound? A.—The intercepting valve is automatically operated by the steam pressure exerted upon it, due to the difference in areas of the ends of the valve.

11. How should a compound locomotive be lubricated? A.—Two-thirds of the allowance for cylinder lubrication should be fed to the high-pressure cylinder while using steam. When drifting for long distances this rule should be reversed, owing to the greater surface exposed in the low-pressure cylinder and the imperfect distribution of oil due to the absence of steam from the cylinders.

12. Why feed more oil to a high than to a low pressure cylinder? A.—Because part of the oil fed to the high-pressure cylinder is carried along with the steam to the low-pressure cylinder, and the high pressure of steam in the high-pressure cylinder causes more friction than exists in the low-pressure cylinder, and the greater the pressure the greater the friction, and consequently more oil is needed to counteract that friction. Because the higher temperature and pressure in the high-pressure cylinder produce more friction, therefore more oil is required for perfect lubrication, and as a certain amount of the oil fed to the high-pressure cylinder is carried along with the steam to the low-pressure cylinder, less need be fed directly to the low-pressure cylinder.

13. How much water should be carried in a boiler of a compound locomotive? A.—Just enough to guarantee ab-

solute safety from overheating the fire box under all conditions of service.

14. Why should no more than the amount which you answer for the preceding question be carried in the boiler of a compound locomotive? A.—In order to assure the delivery of dry steam to the cylinders, as wet steam is particularly injurious to compound locomotives.

15. How should a compound locomotive be started with a long train? A.—Always in simple position.

16. When drifting, what should be the position of the separate exhaust valve, cylinder and port cocks? A.—In drifting, the three-way cock in cab should be in the same position as when working the engine simple, which causes the separate exhaust valve to open. The cylinder and port cock should also be open.

17. What will cause two exhausts of air to blow from the three-way cock when the engine is being changed to compound? A.—A weak separate exhaust valve spring or the exhaust valve itself sticking.

18. What does steam blowing at the three-way cock indicate? A.—A leaky separate exhaust valve seat and steam passing by the exhaust valve piston packing rings.

19. What can be done if the engine will not operate as compound when air pressure on the separate exhaust valve is released by the three-way cock? A.—This indicates that the separate exhaust valve is stuck and communication with the separate exhaust valve has not been closed. A small quantity of headlight oil admitted through the oil plug at the three-way cock and forced to the separate exhaust valve, repeating the operation shortly after with cylinder oil, will generally release the valve.

20. If the engine stands with the high-pressure side on the dead center and will not move when given steam, where is the trouble and what may be done to start the engine? A.—The trouble is due either to a stuck intercepting or reducing valve which prevents direct communication between the boiler and low-pressure cylinder. The position of the intercepting valve stem will indicate which valve is sticking. If the stem extends clear out, it would be the intercepting valve; and, unless some of the posts were broken a light tap on the end of the stem after the throttle is open will send it ahead. If the stem protrudes only a few inches, it will be the reducing valve that is sticking. Usually a few sharp blows on the intercepting valve back head with the throttle open will dislodge it, and direct communication between the boiler and the low-pressure cylinder will be again established.

21. Give reason for your reply to the preceding question? A.—Since the intercepting and reducing valves by their relative positions to the openings in their valve chambers control or prevent the free admission of steam from the boiler to the low-pressure cylinder direct, anything that prevents the free movement of either valve renders both of them inoperative. If the admission of steam into the passage connecting with the intercepting valve cannot move it from its normal position, direct communication between the boiler and low-pressure cylinder cannot be established, and the greatly reduced power conveyed from the high into the low pressure cylinder is entirely inadequate to move the engine.

22. In the event of a breakdown, how should one disconnect? A.—Open the separate exhaust valve as when running simple; then block, cover ports, and disconnect the same as with a single expansion engine.

23. What may be done to shut off steam pressure from the steam chest and low-pressure cylinder? A.—The separate exhaust valve and intercepting valve should be placed in position to allow the engine to work as a single expansion engine.

24. Is it important that air be pumped up on a Schenectady two-cylinder compound locomotive before the engine is moved? A.—Yes, very important.

25. Why? A.—To insure a sufficient amount of air pressure to operate the separate exhaust valve so that the engine can be operated as a single expansion.

26. How are blows in a compound located? A.—That depends entirely on the type. To locate blows or leaks through valves or cylinder packing on two-cylinder compounds, tests are made precisely as with a single expansion engine. Engine should be worked simply—as a simple engine—while testing for such blows. To test blows in intercepting valve, place right-hand crank pin on top quarter and the reverse lever in the center of sector, close intercepting valve and open separate exhaust valve as when working simple. Steam will pass through the separate exhaust valve and appear at the exhaust nozzle, if the intercepting valve blows.

27. To what ports are the by-pass valves conected and why are they used? A.—To the steam ports, and they furnish communication between steam chest and steam ports in cylinder. They are used to relieve the cylinder from excessive back pressure when drifting.

28. Why are the four-cylinder Schenectady compound locomotives in service here called tandem compounds? A.—Because the high-pressure cylinder is ahead of and connected with the low-pressure cylinder, and both pistons are operated by the same piston rod.

29. Does the steam in a tandem compound locomotive exhaust from left to right cylinders in a similar manner to the cross compound? A.—No, the steam from the high pressure passes over to the low pressure on the same side.

30. Are the valves on a tandem compound locomotive designed to give outside or inside admission of steam? A.—The valves on a tandem are designed for both inside and outside admission.

31. What arrangement of steam ports have these engines, so that an outside and an inside admission valve may be operated by one valve? A.—On the high-pressure cylinder the valves are arranged for internal admission, and the steam ports in the high-pressure cylinder are crossed. On the low-pressure, the valves are arranged for external admission and the steam ports are those in use on the ordinary type.

32. Trace the course of the steam from the high-pressure valve to the atmosphere when working compound? A.—Since both valves operate on one stem, and as the high-pressure valve is internal and the low-pressure external admission, the ports in the high-pressure cylinder must necessarily be crossed, so that when live steam is admitted to one end of the high-pressure cylinder the exhaust from the opposite end of the high-pressure can pass over into the low-pressure cylinder to exert its energy in the same direction and in unison with the high-pressure.

Steam leaving the high-pressure valve and entering the back port in the high-pressure cylinder flows to the forward end of the cylinder, forcing the piston back. After spending its force it is exhausted to the high-pressure steam chest, passing through the center of the hollow high-pressure valve to the outer back edge of the low-pressure valve, enters the back end of the low-pressure cylinder, and after spending its force escapes through the exhaust port of the low-pressure valve directly to the atmosphere.

33. When and how may a tandem compound be operated as a simple engine? A.—Only in starting or when there is a possibility of stalling. It can only be operated as a simple engine when the starting valve is used.

34. What steam passages have communication with the starting valve? A.—The high-pressure steam ports and the passages surrounding the by-pass valve.

35. How does manipulation of the starting valves cause the engine to operate as simple? A.—The starting valve, which is operated by a lever in

the cab, admits live steam directly to the low-pressure cylinder in the following manner: Steam is admitted to the high-pressure steam chest through the short steam pipe connecting saddle and chest, passing through suitable ports and around by-pass valves which register with the high-pressure steam ports. The by-pass valves are held against their seats by the pressure from below, which is in direct communication with the chest. The starting valve, having thus established communication with both high-pressure steam ports, steam passes through both hollow piston valves and is admitted to the low-pressure cylinder.

36. What other valves are in the starting valve casting? A.—The by-pass valve.

37. How many sight feeds to lubricators of a tandem compound, and what do they lubricate? A.—There are two lubricators each with a double sight feed and each sight feed lubricating only one of the four valves and pistons.

38. How should the oil used be distributed? A.—When the engine is working, the high-pressure should receive the greater and the low-pressure the lesser quantity, and when drifting these proportions should be reversed.

39. How should a Schenectady tandem compound be disconnected, in case of a breakdown on the road? A.—Just the same as a simple engine with reference to blocking crossheads, covering ports, etc.

GENERAL Questions Answered

THEORETICAL EFFICIENCY OF A STEAM ENGINE.

(41) Student, Pittsburgh, Pa., writes:

When a locomotive uses 4 lbs. of coal per horse power per hour, what is the theoretical efficiency of the engine with coal containing 14,500 heat units? Please give the rule for finding the answer. A.—First we find the total heat units in the coal used, which is $14{,}500 \times 4 = 58{,}000$. Then we find the total number of foot pounds exerted by the engine in one hour. One horse power is 33,000 lbs. raised one foot in one minute. The measure of that for one hour is $33{,}000 \times 60 = 1{,}980{,}000$ lbs. raised one foot, so called foot pounds. That amount of power divided by one heat unit, 778.8, gives 2,542.4, the heat units used by the engine per horse power per hour. When that is divided by the number of heat units in the 4 lbs. of coal used, viz., 58,000, the quotient is 0.0438, the theoretical efficiency of the engine.

A shorter plan to work out the same problem is to divide the horse power unit by the thermal unit, divide the quantity of coal used by 60, the number of minutes in an hour, then use the quotient for a devisor on the thermal unit divided by the horse power. The problem then becomes $33{,}000 \div 778.8 = 42.37$. Then $42.37 \div 966.6 = 0.0438$, the theoretical efficiency of the engine.

POWER OF LOCOMOTIVE BACKING UP.

(42) T. E. C. St. Paul, Minn., writes:

Would an engine backing up have a tendency to make the flues leak any sooner than if the engine was going ahead or working in forward motion, and if so, why? A.—When a locomotive is backing up there is the extra pressure due to the speed forcing cold air into the fire box door. This is sufficient in some cases to start the flues leaking.

METALLIC PACKING FORMULA.

(43) H. A. B., Owasso, Mich., writes:

Will you please give me the formula generally used by our leading roads for metallic valve stem and piston rod packing? A.—The original U. S. Metallic Packing Company's formula was: Tin 100 parts, copper 9, antimony 6; total, 115 parts. These three metals stood in the proportion of 87 per cent., 7¾ per cent. and 5¼ per cent., respectively. If the alloy so made is too hard for some conditions, a reduction of the antimony to 3 parts instead of 6, with the tin and copper as they were, gives very good results.

Some roads use a lead babbitt packing made of 80 parts lead, 12 tin, phorphor tin 3, and antimony 5; total 100. Others use a slightly different proportion thus: 74 lead, 17 tin, phosphor tin 3, antimony 6. This last is perhaps not quite as good as the preceding formulas, but can be used with very little machinery. Packing should be made very carefully, and it can also be made cheaply if proper methods are employed.

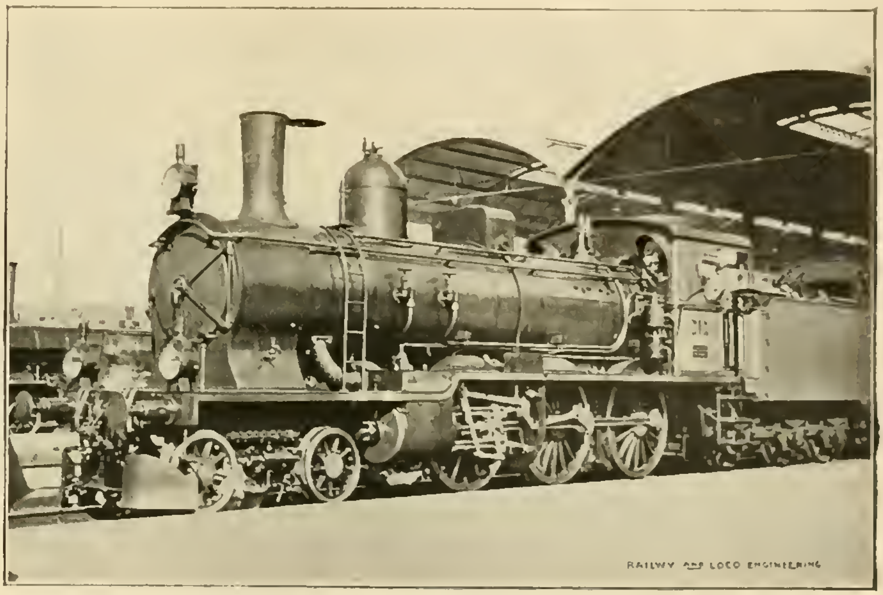
BRAKE POWER WITH FLANGED SHOE.

(44) J. M., Grand Island, Neb., writes:

How much more braking power is there on a passenger car with flange brake shoe than if shoes had no flange on them? A.—According to a committee report of the Air Brake Association, a flange shoe gives from ten to thirty per cent. more braking power than a plain shoe of the same metal.

HIGH SPEED REDUCING VALVE.

(45) J. R. E., Cleveland, Ohio, writes:



ST. GOTHARD EXPRESS AT LUCERNE, SWITZERLAND.

They say a high speed valve will blow off air as fast as it will go to the brake cylinder service application. It will not, so I find. How is this? A.—This statement should be qualified. In a service application, made continuously, the high speed reducing valve will open at about sixty pounds and blow, but will build up cylinder pressure four or five pounds above sixty, while blowing continuously. However, if the service application of the brakes be made in installment reductions, as is usually the case, the reducing valve will blow off quickly each time and keep the cylinder pressure close to the figure the valve is adjusted for. But the valve can be crowded so it will not blow down as fast as it receives the pressure.

HAULING POWER AND PISTON STROKE.

(46) R. F. E., Pittsburgh, writes:

If we take an engine with 20x24 in. cylinders, and 50 in. wheel centers, and apply new cylinders 24x28, and new driving wheels of the same size, 50 in. center, what would we have gained theoretically, and what difference could we expect in the hauling capacity of the engine? In other words, will the increase of stroke, without making any change in weight or boiler pressure, enable the engine to haul more? Would she be any more liable to slip than previously, and if not, why not? A.—The engine with cylinders 20x24 ins. and wheels 57 ins. outside of tires, when carrying 200 lbs. boiler pressure would have over 28,600 lbs. tractive power. The engine with cylinders 24x28 ins. with the other proportions the same, would have over 48,000 lbs. tractive power. Of course, the tractive power would be inefficient without the necessary weight on the drivers to keep the engine from slipping. The first engine would need 128,000 lbs. weight on the drivers; the second would require 216,000 lbs on drivers.

TIE TRAIN UNLOADING BETWEEN FALMOUTH AND PENRYN IN GREAT BRITAIN.

HIGH SPEED REDUCING VALVE.

(47) J. R. E., Cleveland, Ohio, writes:

I set the high speed valve at sixty pounds exactly. After that I locked the cap nut on. Then the valve blowed at sixty-four and sometimes sixty-six. Why was this? When I screwed the cap off, the valve blowed all right at sixty, but locking the cap nut on would change the adjustment. A.—Probably the hole in the cap nut which provides for the escape of leakage past the piston into the spring case was closed by ice or other foreign matter. Possibly the small cork placed in the hole by the manufacturer when shipping, had not been removed. The stoppage of this hole causes leakage to accumulate and assist the adjusting spring to push the piston up and close the valve earlier and at a higher pressure than it was set for.

POSITION OF MOVEABLE PULLEY.

(48) J. M., Grand Island, Neb., writes:

I have an engine on her side and I want to pull her on her wheels with a block and tackle, and I have a "dead man" which will hold. I have a block with two sheaves or pulleys and a block with three sheaves. Which do I use next the engine, the two or the three pulley block? A.—You ought to fasten the three pulley block to the engine which you wish to move, because in that way you will have one more subdivision of the rope to help increase your pull. See article on that subject on page 365 of the August, 1900, issue of RAILWAY AND LOCOMOTIVE ENGINEERING.

STRAIGHT AIR BRAKE.

(49) T. M. H., Elkhart, Ind., writes:

Why will the straight air brake go on sometimes and you can't get it off? A.—A leak in the automatic train pipe is sometimes sufficient to cause the triple to send auxiliary reservoir pressure to the double seat check valve, shifting it to the automatic position and trapping a part of the straight air in the brake cylinder. It will then be impossible to release the brake with the straight air brake valve, but if the automatic brake valve has been carried in the running position and excess pressure has been accumulated, the brake may be released by going to full release with the automatic brake valve. Be careful to always carry the straight air brake valve in full release and the automatic brake valve in running position.

KNUCKLE JOINTS AND SIDE RODS.

(50) E. E., Grand Rapids, Mich., writes:

First—We have a Brooks ten-wheel engine here, which has the knuckle joint on the side rod ahead of the main pin on one side of the engine and behind the main pin on the other side of the engine. Forward and back drivers are equal distances from the main driver. Is this a mistake in putting up the rods, or not?

Second—If an engine breaks the main pin on one side so that all the rods on that side must come down, can the side rods on the opposite side remain up? If not, why not?

Answer.—First: If your leading and trailing drivers are an equal distance from the main driver so that they tram the same, it would make no difference whether the knuckle joint was ahead or behind the main pin, so long as the rods were of the same construction, weight and diameter. If, however, there is any lost motion in the knuckle joint on either side, it throws an additional strain on the opposite side which would cause trouble. It was probably an oversight due to a rush job.

Answer.—Second: Yes, an engine can be brought in with the side rods left up on one side, but it is not a safe practice. With an engine just out of the shop, boxes, wedges and rods snug, it can be done, but there is always a risk and the man who does it takes chances. When your engine is drifting it is never a certainty that all brake shoes exert the same amount of adhesion. You have but one rod, but you have two wheels on the same driving shaft and may spring the rod. When your engine is working steam, it is never certain that the pins controlled by the side rods will reach and pass the dead center as early as the main pin. If they do not, one wheel is forced backwards, while the other is moving forwards. With the large consolidation engine it is impossible to move the engine with just the main rod up, due to the loss of adhesion. Even then I should wire my superior for instructions and let him take the risk. We have records of engines that have been brought in safely that way and also where they not only stripped the good side of the engine, but derailed her.

Fir will grow at as great an altitude as 6,700 feet above sea level, yellow pine at 6,200 feet, ash at 4,800 feet and oak at 3,350 feet. The vine ceases to grow at about 2,300 feet.

Railroad equipment orders are breaking all records. The railroads of the country, it is estimated, will expend $200,000,000 during 1905. Ten of the leading lines are expected to invest $110,000,000 in traffic improvements.

Air Brake Department.

CONDUCTED BY F. M. NELLIS.

The New Orleans Air Brake Convention

When this issue of RAILWAY AND LOCOMOTIVE ENGINEERING reaches its subscribers, many of them will have completed their arrangements to attend the Twelfth Annual Convention of the Air Brake Association at New Orleans, beginning April 11, which event promises to be one of the most successful in the history of that organization.

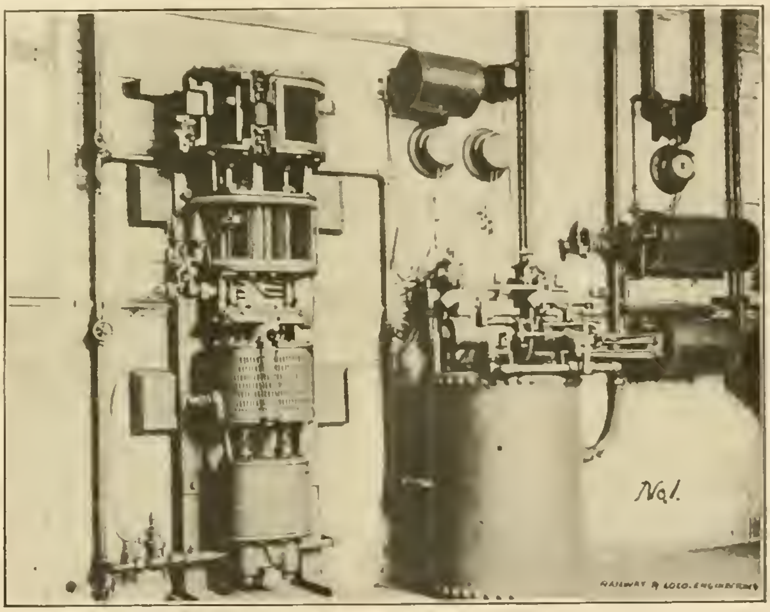
It has been truly said that railroads have made history. It is equally true that the air brakes have assisted in this history making to a degree quite unappreciated. Railroads, by making more intimate communication between remote places, have opened up the way into new territories for settlement and development. The single track, light power and rolling stock period is already behind us, and the attempt to operate the heavy tonnage of to-day on yesterday's lines would fail utterly. Mammoth locomotives and capacious cars are necessary to handle modern traffic.

But no chain is stronger than its weakest link; and no express train could be run more swiftly or freight train haul greater tonnage than could be stopped in a safe distance. The air brake has kept pace, and, indeed, has even preceded its associate, the positive accelerating power, and has met the requirements, without which, high speeds and heavy tonnage would be impossible.

Due credit, then, to the air brake inventor! Due credit also to the Air Brake Association, whose work has been and still is the reclamation of air brakes from the neglected and useless condition into which they drifted during the rush of compulsory legislative application. Dut credit, then, to this active young organization, whose motto is: "To improve the air brake service on American railroads."

Latest Air Brake Book.

The month of April, 1905, brings to us a new air brake book, in the form of the Standard Progressive Questions and Answers on the Air Brake, revised and brought up to date by the Air Brake Association. Both the Westinghouse and New York systems have been exhaustively treated by specialists from these two companies, thus placing between the covers of one book undoubtedly the most comprehensive and elaborate treatise on these two systems yet presented. That part pertaining to inspection, maintenance and operation has been prepared by actual service men, called in for the purpose from the firing line of every-day experience. Thus a revision corps has been obtained which is well fitted to supply an air brake book suited equally well to the beginner and the advanced student. The beginner, if he applies himself, will be fitted to pass any air brake examination, and the advanced student will be entertained and kept up to date in both the Westinghouse and New York air brake systems. No air brake library will be complete without this book. We have it in paper binding for $1.50 and leather for $2.00. Sent to any address, postage prepaid.



AIR BRAKE INSTRUCTION ROOM, SPRINGFIELD, MO., ST. LOUIS & SAN FRANCISCO RAILROAD.

CORRESPONDENCE.

Air Brake Instruction Room.

This shows two views of something neat and instructive in the way of an air brake instructive room. The room is located in the end of the roundhouse adjoining the engineer's room at Springfield, Mo., on the Frisco System.

View No. 1 shows a section of a No. 2 duplex air pump operated in a tandem with a No. 1 air pump, so as to show the movement of the slide valves and pistons, all the above being operated by air pressure. A sectional duplex pump governor is attached to the No. 2 pump, and air connections piped to sectional New York engineer's valve, so one can understand in what position of the engineer's valve each side of the governor is attached to. A single governor is attached to the No. 1 pump, and air connection piped to the Westinghouse engineer's valve the same as in service.

To the right of the air pump and on top of a main reservoir, are sections of the New York and Westinghouse engineer's brake valve coupled up and working in tandem, and so piped that either the Westinghouse or the New York brake valves can be used in explaining the operation of the air brake, or to show doubling heading.

To the right of the engineer's valve is a sectional plain triple valve as used with 6 in. and 8 in. cylinders, coupled up and working in tandem with a live plain triple valve. Under this triple and auxiliary reservoir there is a Westinghouse slack adjuster coupled up as in service.

View No. 2 shows 6 cars coupled up, three Westinghouse and three New York triple valves being used. Over the first car is a sectional New York quick action triple valve, auxiliary reservoir and brake cylinder working in tandem. All pipes and connections are made to conform with the car equipment as near as possible.

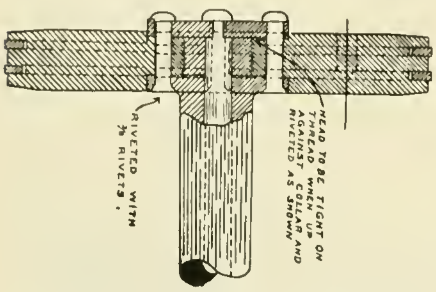
In the same room are sections of all parts of the air brake, injectors as well as colored charts of both New York and Westinghouse brake equipment, which gives the engineers an opportunity to visit the room at any time and study the different parts of the brake equipment. C. J. S.

Springfield, Mo.

New Fastening for Reversing Plate and Piston.

Here is a sketch of a new fastening for reversing plate and air pump piston which we are trying. We are securing the reversing plate with three rivets instead of two.

The breaking away or pulling off of pistons and reversing plates coming



STRONGER FASTENING FOR REVERSING PLATE ON PISTON. SIDE SECTION.

loose so frequently has caused a lot of trouble and delays. The condition under which this is done is hard to meet, so we have decided to break away from the standard and strengthen the weak points. The arrangement illustrated herewith has proved O. K. so far.

R. N. MARTIN, P. R. R.

Renova, Pa.

Water in Train Pipes.

I have read Mr. Burton's very able article on frozen triples and train pipes, and I must say that the experience that I have had with these difficulties leads me to believe that the cause of all this trouble is insufficient radiation. Experiments that I have made to overcome that difficulty, also lead me to conclude that there are better methods of obtaining radiation than by an extension of piping between pump cylinder and main reservoir. The trouble with that is the changes of temperature and train lengths make it liable to freeze up, and then it becomes a source of danger. I know of instances where in severe cold radiators have frozen up; and in one instance, the single pipe about 7 ft. long froze between the pump cylinder and main reservoir. These occurrences were both on passenger trains of short train line. The last would indicate that we had better lag the 7 ft. pipe instead of lengthening it out.

I know of engines equipped with one reservoir in heavy freight service, and having about 28 ft. of pipe between pump and main reservoir that freeze up where the train pipe crosses the bolster of back tank truck. Take this same class of engine and start out with snow plow or flanger, and the discharge pipe will freeze up. This leads me to conclude that for all conditions of service, first, the shorter the discharge pipe between the pump and main reservoir, the better, and if you place a deflector on the inside of main reservoir to throw the moisture down, where it comes in contact with a frozen surface, and that grabs the moisture and holds it, while the free air enters train pipe on opposite end of main reservoir unencumbered with sand, ashes and moisture, substances that help to render ineffectual the working of triples at a most perilous time (winter).

The writer of this article has not had a single case of frozen triples on the engine that he is running during all of last winter and so far this winter. Engine is in passenger service and equipped as the print (see March issue) shows. In freight service the radiation must, for safety's sake, be done with reservoirs, and not with any pipe radiators. Two reservoirs of liberal dimensions for freight service will preclude any possible chance of moisture passing engineer's brake valve into train line, where the deflector is used on front heads of both reservoirs.

The writer believes that placing the train line pipe and discharge pipe from the pump side by side on one reservoir head is wrong for this reason: The vacuum created in main reservoir, in recharging train line and auxiliary after an application of the brakes, has a tendency to draw the sand and ashes and moisture into train line, cutting rotary seat, making it work hard and fouling the triples and filing the train pipe with ice.

The rotary brake valve seat has not been faced, cleaned nor oiled in two years, and is as tight and works as good to-day on the engine that the writer is running as when first applied. You could not face a rotary for the price of the deflector. E. BEARRS,

Eng'r, N. Y., O. & W. Ry.

Ellenville, N. Y.

Air Pump Throttling.

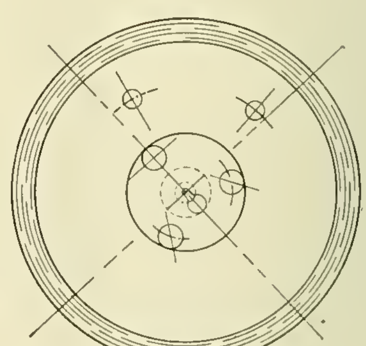
After reading in February number the account of Mr. L. M. Carlton on running air pumps, I wish to enter a protest on his putting a reducing plug in the steam pipe to the air pump. Probably his idea may work O. K. on the C. & N. W., but here on the D., L. & W., I would not care to see it tried on freight trains.

Here we have large Mother Hubbard hard-coal burners, and we have grades 17 and 18 miles long, 75 to 98 ft. to the mile. We stop to test our air at summit of mountain. After testing, we have to pull train about half a mile. Going down the mountain, the fireman generally cleans his fire, and he often starts to do so while we are yet pulling the train. I have seen a boiler lose 100 lbs. of steam in this half mile. We must also use injector so as to have engine full of water going down mountain. Nearly every trip down, while fireman cleans fire, our steam pressure falls to 110 or below.

We use the high pressure control on coal trains, and take down about 30 loads. Now, I find that when steam pressure comes down to 110 lbs. a full throttle on air pump will not race it, it will hardly make any more air than is needed to control train at a speed of 15 miles per hour. Now, suppose we had a reducer in steam pipe to air pump, where would we be at?

Would it not be a better idea to put a reducing valve in steam pipe to air pump, something on the order of the reducing valves used in steam heating train, set it at 110 lbs. and then use wide open steam throttle? This reducing valve could be made so it could not be tampered with on road.

The late C. F. Thomas used a reducing valve on engines to regulate steam to electric light dynamo, and set it at a certain pressure. He had it set and locked, and kept the key to same, in care of roundhouse foreman. No one could tamper with it, and he had as good an



THREE BALL FASTENING FOR REVERSING PLATE.

electric headlight as I ever saw anywhere since on any road.

Stop the leaks in train line. Don't insist on an engineer leaving a terminal without his train line pumped up. Back him up if he refuses to go out without his train pumped up, and you will soon have an improvement in pumps and air equipment. E. ROSE,

Engr., D., L. & W. Ry.

Scranton, Pa.

Automatic Lubricator for Air Cylinder of Air Pump.

I send you herewith drawings and a description of a lubricator for air brake pumps which I believe will be interesting to your readers.

The object of this lubricator is to provide simple, effective and reliable

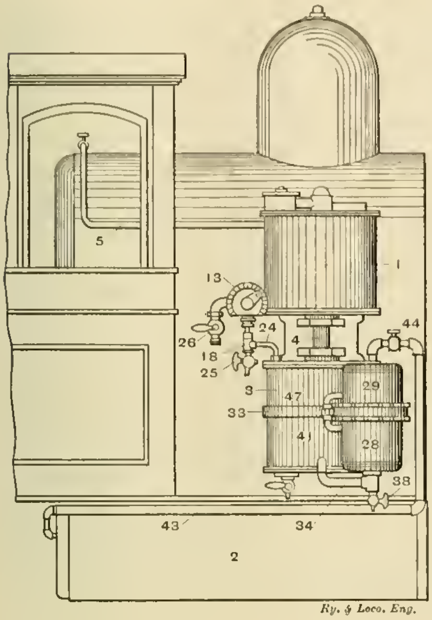


FIG. 1.

means for automatically moistening and lubricating the piston and walls of the air cylinder of the air pump. By the use of this device, the air ports are kept free, and burn to oil and gum is obviated around the valves and air ports. This tends to increase the life of the piston packing and the walls of the cylinder, and prevents them from rapid wearing, as is now the case.

Fig. 1 illustrates the pump and lubricating attachment, fastened to the side of a locomotive, and gives in a general way an understanding of the device mounted on an air pump. This shows the lubricator and air filtering devices associated with the air pump.

As will be seen by reference to Fig. 1, the device takes a portion of the exhaust steam from the steam cylinder, through a pipe and connections, to the air cylinder. The exhaust steam in passing from the steam cylinder to the air cylinder, passes through a regulating valve having an adjustable feed by which means the quantity of moist steam passing to the air cylinder to lubricate it may be regulated to any degree. With this adjustable feed, the valve can be accurately adjusted so as to pump the desired amount of exhaust steam through the connections to the walls of the air cylinder and its piston.

Fig. 2 is a sectional view of the feed and regulating attachment which controls the supply of exhaust steam to the air cylinder. The arrangement of this device pumps to the air cylinder a small jet of exhaust steam at each complete movement or stroke of the air piston, thereby supplying sufficient moisture to the air cylinder to prevent the piston packing from becoming dry and burning out, a difficulty which is very frequently encountered in air pumps.

A test cock, 25, enables the engineer to tell at any time whether or not sufficient exhaust steam is being admitted to the air cylinder. A drain cock, 26, is supplied for draining off the contents of the steam cylinder whenever necessary.

Fig. 3 illustrates an attachment to the pump which filters the liquid and moisture from the air before it finally passes to the main reservoir, 2. The air, after leaving the air cylinder, is conducted through pipe 34 into the air filter, comprising liquid and dry chambers, 28 and 29. These two chambers have their adjacent ends connected with a coupling, having flanges, 31, between which is received pin, 33, which unites the pump cylinder and holds the air cylinder in place thereon. The chambers, 28 and 29, are connected by a pipe, 41, made in sections and coupled together at 47. The air filter is also provided with a drain cock, 38. The air, after leaving the filter passes through pipe 43, thence to the storage tank, or reservoir, 2.

It will, therefore, be seen and understood that at each full movement of the steam piston a small portion of exhaust steam is pumped through the pipe into the upper portion of the air cylinder, with the result that the inner wall of the air cylinder and the piston packing are kept moist, and the heating of the packing prevented. This also has the effect of keeping the air valves clean and all the air appliances in good order.

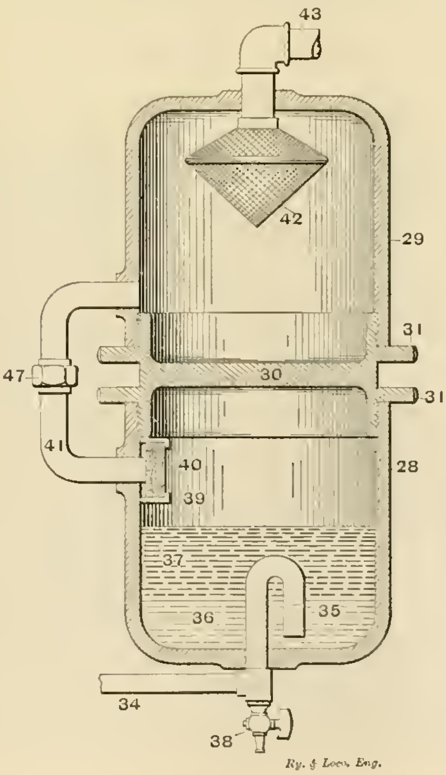


FIG. 3.

It is unnecessary to oil the brake valve and air piston, as actual test has

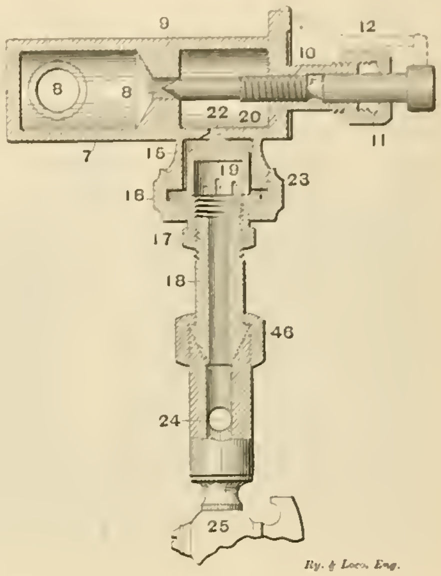


FIG. 2.

shown that the pump will operate successfully with this lubricator for a period of from three to six months, without attention.

Should the piston packing become too dry, the regulating valve may be opened up to admit an excess amount of steam for a short time, until the packing becomes thoroughly moistened, then the regulating valve may be again set to pump the desired amount of exhaust steam for a continuous trip.

This device has been successfully in operation on engines in this section for six months past, and has given excellent satisfaction. Both the enginemen and roundhouse men are loud in their praise of its operation and the beneficial effects it has upon the piston packing and walls of the air cylinder.

T. M. HENDERSON.

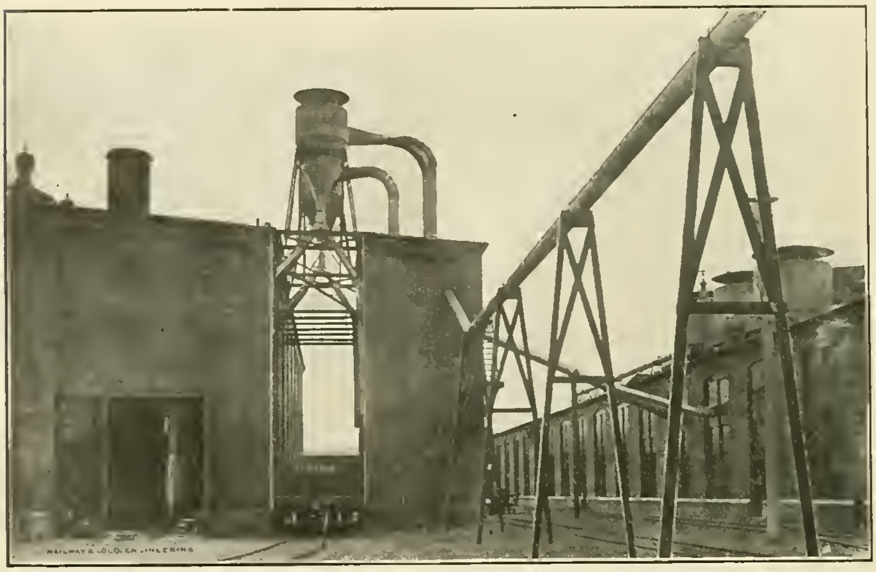
Portsmouth, Va.

The old 25 cent edition of the Progressive Form of Questions and Answers on the air brake, gotten out by the Air Brake Association, is now exhausted and out of print. A much better, more complete, and up-to-date book takes its place. Ask for the Air Brake Association Revised Book on the Westinghouse and New York brakes. Send for a trial copy. Paper bound, $1.50; leather, $2.00.

German locomotive engineers receive a gold medal and $500 for every 10 years of service without accident.

Dust Collecting System.

What is probably the largest dust collecting system on this continent has recently been put in operation in the Angus shops of the Canadian Pacific Railway, at Montreal. The work of installation was done by C. H. Gifford & Company, who are the managers of the Philadelphia house of the B. F. Sturtevant Company, of Hyde Park, Mass.



BOILER HOUSE, REFUSE STORAGE BIN AND CAR TO RECEIVE OVERFLOW OF REFUSE WHEN NECESSARY, AND CONVEYOR PIPES. STURTEVANT SYSTEM.

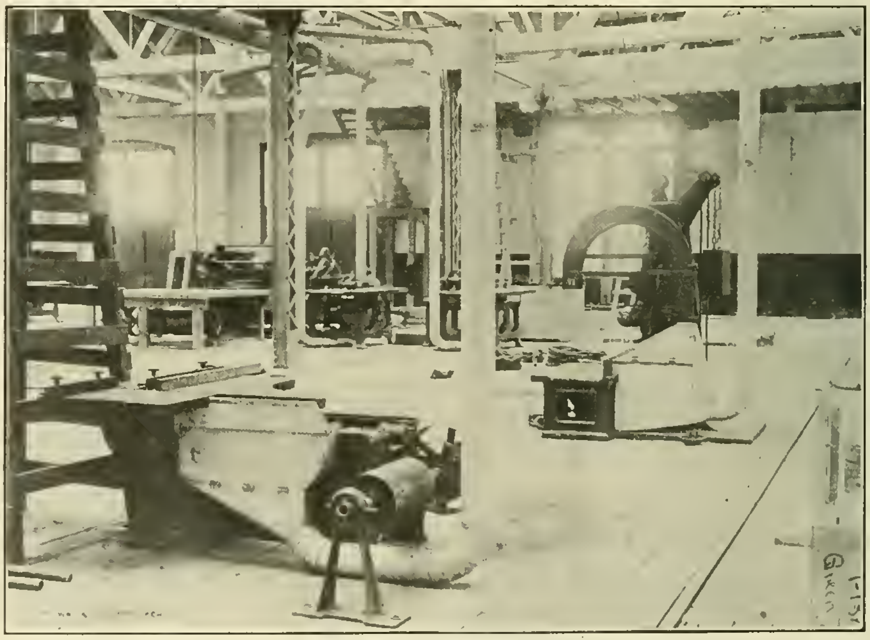
The equipment consists of seventeen exhaust fans and six enormous dust collectors. Three of these are located upon the roof of the planing mill and one upon the cabinet shop, while two others into which they discharge are supported above the boiler house. All of the woodworking machines are hooded in the most approved manner so as to insure the maximum suction at the point where chips and shavings are made.

Not only can the light thoroughly dry refuse from the cabinet shops be handled in this way, but chips which are made by the heavy machines in the planing mill are drawn up and discharged to the collectors. The material is largely oak, wet, heavy and stringy, and frequently with an inch or so if ice which has to be taken off at the same time. The suction fans vary in speed from about 650 to 825 revolutions per minute, and the greatest distance through which refuse material is conveyed is about 700 ft.

The advantage of this system as compared with any method of collecting refuse by the hand is two-fold. In the first place not only is the expense of handling greatly reduced, but the refuse material is at once rendered available for fuel.

The boilers for the woodworking shops are four in number and are of about 425 h.p. each, or 1,700 h.p. in all. These may be fed entirely with shavings, which would otherwise be costly to transport and dispose of.

At the boiler house additional fans are located which draw the refuse from the first set of collectors and discharge it to the second set, from which it is delivered either directly to the boilers, or deposited in the shaving house. When the boilers are not in operation and the surplus is too great, it is also possible to dump the refuse directly into cars, which can be placed beneath the delivery pipes. The car track is placed between the boiler and shaving houses. The feed pipes of the boilers may be swung out of position when not required.



DUST COLLECTORS ON WOODWORKING MACHINERY, ANGUS SHOPS, C. P. R., MONTREAL.

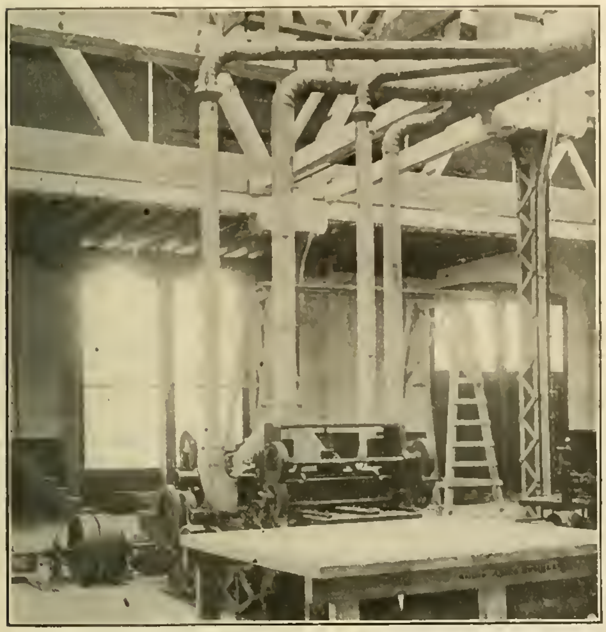
This installation is an illustration of the high efficiency of operation which may be secured by careful and thoughtful design. The power required to operate the fans is small and the annual saving effected by the use of the system will probably go far to pay the total first cost of the equipment.

New South Wales Wants to Develop Locomotive Building.

New South Wales is ruled by labor union elements and is decidedly a free-trade country, with rather embarrassing results sometimes to the people at large. The colony needed a supply of locomotives lately and the Railway Commissioners issued specifications and called for bids. When these were all in the Railway Commissioners awarded the contract to the Baldwin Locomotive Works because that company offered to deliver the engines for six thousand dollars an engine less than they could be built for in New South Wales.

That decision caused great excitement, and what might be termed a finance-labor storm is still raging with fierce violence. The labor element insists that the locomotives ought to have been given to home builders no matter what the cost might have been, and the other side holds to the principle of purchasing from the lowest bidder.

We notice that certain American journals are expressing astonishment that the people of New South Wales should for a moment consider the propriety of encouraging home industries at the expense of sound trade principles. It makes a difference whose ox is gored. Our protectionist advocates see no injustice in keeping a tariff of eight dollars a ton on steel rails for the protection of our Steel Trust, but they are shocked at the idea of the workmen in foreign countries demanding that a similar policy be introduced for their benefit.



REFUSE COLLECTING PIPES IN WOODWORKING SHOP, CANADIAN PACIFIC RAILWAY, MONTREAL.

There are quite a number of new alloys to choose from for the various uses which railway service demands, as set forth in Bulletin No. 11, issued by the Buda Foundry & Manufacturing Company, of Chicago. These alloys they call Buda metals, and, though they do not reveal the formula which is used in the production of the alloys, they give an idea of the composition of each and the use for which it is adapted. For instance, Buda Aluled is an anti-friction metal with base of lead and aluminum. Buda Loco Bronze has high tensile strength, toughness and durability and is intended for driving box brasses. In each case where an alloy is mentioned, a suggested test is given which can be made in the foundry or elsewhere by any intelligent man. If you would like to have a copy of this neatly printed and interesting little pamphlet write to the Buda people and they will be happy to send you one.

A locomotive belonging to the London and North-Western Railway had, since 1882, and up to 1902, made 2,000,000 working miles. The time out of service for repairs averaged only 12 per cent. of the working time credited the locomotive.

Would Keep Up the Argument.

When six-wheel connected locomotives were first introduced upon the Grand Trunk of Canada, two of the division master mechanics, both Scotsmen, made the extra pair of wheels the subject of controversy every time they met. One day when they were both violently worked up in a heated argument on the thread-worn question, a bystander remarked: "Your men's quarrel reminds me of two of your countrymen who had grown gray in a life-long argument concerning infant damnation. It came to pass that Thomson, the advocate of unbaptized children going to hell, met his opponent, Brown, one day and remarked, 'Brown, mon, we've argued long an' suir aboot the destiny o' the bairns, noo a've come ta think as ye dae on the subject.'

"'Ye've come soon .o ma way o' thinkin', hae ye? Weel if that's true, a've cheenged ma min', so we can keep the auld argument gaen.'"

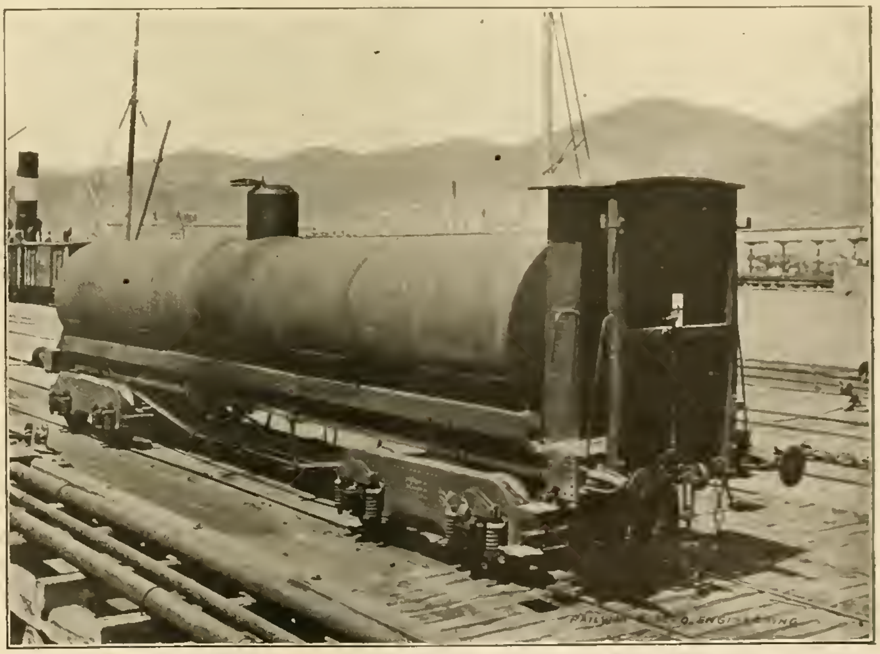
A newspaper paragraph circulating through the press says that travelers in Russia are provided with bed clothes separate from the sleeping car berths, and pay extra for their use. It may be that travelers in ordinary cars can purchase the use of bed clothes in Russian trains, but in sleeping cars the beds are made up the same as they are in other countries, and the traveler pays for the sleeping accommodation in the same way as he does in the United States. The writer has traveled repeatedly in Russia and knows whereof he speaks.

Novel Oil Tank Car.

Our illustration shows a rather curious oil tank car used on Russian railways. The tank itself is, of course, very like the oil tank cars with which we are familiar, but the make up of the whole vehicle may fairly be described as odd.

The horizontal and circumferential seams are double riveted, and the horizontal seams in each course are placed alternately on one side and on the other. The dome has a large cap which swings clear round one stud, and when the cap is in place it makes a face joint with the dome ring and is fastened down with a sort of bridge clamp.

The frame of the car fits closely to the under slope of the cylindrical tank, and thus brings the car sills inside the line of the truck sides. The trucks are steel and the boxes work up and down in jaws, but the larger part of the box projects beyond the truck sides, and each box carries a sort of equalizer on top, and from each end of an equalizer there are two hangers which pass



RUSSIAN RAILWAY OIL TANK CAR.

through the center of two coil springs and terminate in large flat washers. The upper ends of the coil springs are secured in the projecting top of strong brackets fastened to the truck sides. The weight of the car is transmitted to the tops of all the coil springs, and the hangers being fastened to the flat washers at the lower ends of the coil springs, the weight of car and load is transferred through the box equalizers to the box roofs, the brasses and the journals.

The interesting feature about the car is the curious little wooden shed at one end of the car. It is not much wider than the smallest space a man can stand in, and it has but scanty side protection, and no doors are used at the entrances at each side. The front of the shed is covered with sheet iron and an oblong hole is cut in it which permits the operation of the hand brake. The upright posts of the shed have sockets for lamp or flag.

The object of the shed is to afford protection to the brakeman who, when stationed on one of these cars, has no means of leaving his post while the train is in motion. Side running boards or hand rails have not been included in tnis design of oil cars, and often on long runs over the bleak north country, through which the railroad passes, this odd-looking brakeman's shelter must be very acceptable indeed.

Handy Folder.

The H. W. Johns-Manville Company have their office at 100 William street, New York, and from that office they have just issued a small pocket folder in which they invite attention to the subject of flange joint gaskets in general and to their own flange joint gasket in particular. They consider that the essential features of an efficient gasket for steam flange joints are that it shall withstand the highest temperature and pressure. That it will be sufficiently elastic to compensate for expansion and contraction, but that it is not itself to expand or contract with changes of temperature. That it will maintain a perfectly tight joint against the vibration of the pipe line, and that it will prevent leakage of steam or condensation. The gasket which this company has put upon the market in view of these requirements is known as the "Kearsarge" flange joint gasket. It is made of a superior quality of asbestos cloth, with fine brass wire interwoven in the individual strands, folded two-ply thick (1/8 of an inch), the whole saturated with a special heat-resisting compound. If you want to learn more about these gaskets write to the company and ask them to send you a copy of their pamphlet, which they will be pleased to do.

PRESSED STEEL HOPPER BALLAST CAR FOR THE UNION PACIFIC.

Hopper Ballast Car.

The Union Pacific have a very serviceable ballast car which we have been able to illustrate through the courtesy of the Pressed Steel Car Company, of Pittsburgh, Pa., who are the builders.

The car has a pressed steel frame like that of a flat car and from this rises what is really a steel box with a hopper bottom by which the load can be discharged onto the center of the track. The rated capacity of this car is 100,000 lbs.

The supports of the box and hopper and the stiffening pieces under the hopper are angle irons. There is a good platform at each end of the car and on the brake end a man who has at any time occasion to apply the hand brakes has a safe place to stand.

The car is 40 ft. long over end sills while the inside length of the body is 32 ft. 7¼ ins. The doors of the hopper are 23 ft. 10¾ ins. in length, which insures the complete dumping of the entire load. The inside width of the box is 8 ft. 8½ ins. This gives a cubical content, when the load is level, of 1,250 cu. ft. When the load has an average heap of 10 ins., the cubic contents can be brought up to 1,487 cu. ft.

In the matter of dead weight this car has been designed so as to keep it down to the lowest terms. The dead weight of the body is 21,300 lbs., and that of the trucks 15,030 lbs., making a total of 36,330 lbs. The ratio of paying freight to total weight of car when loaded is 75 per cent. For light ballast, extension boards may be used at the top of the box in order to get the full load capacity which is about 110,000 lbs.

The height of the car body from top of rail is 8 ft. 3 ins. This ballast car is a very substantial vehicle; the center sills being reinforced with angle irons, makes them practically equal to steel girders, and as all the draw gear and buffing shocks are taken in the line of these sills there is no tendency to bump the car up in the middle or to cause it to sag in every-day service. No truss rods are used.

The longevity of steel cars could no doubt be considerably increased if when ordering the railroad companies would specify the using of some good paint, especially made for the preservation of steel. The initial cost might be a trifle more, but when the cost of repainting, the time the car is out of service and the increased life of the car is taken into consideration the extra expense would be more than offset.

Every man's task is his life preserver.—*Emerson.*

Of Personal Interest.

Club Raisers and Readers Please Note.

We are anxious to make the personal columns of RAILWAY AND LOCOMOTIVE ENGINEERING as full and as accurate as possible, and with that end in view we would ask our club raisers and interested readers to give us their kind assistance. If there is any change of officers or promotions on your road we would like to hear of them. When you send us in a "personal" model it as nearly as you can on the form of notice which you see each month in our paper. We want the name of the man appointed, his former position, his new position, the name of the railroad he is connected with written out in full, the name of the city or town where his office is, and, if possible, the name of the man he succeeds, and whether the retiring officer has resigned, been transferred, or has accepted another position. One word further to the newly appointed railroad officer: Do not be ashamed to send the notice yourself. If you do it, it will be correct. It is also strictly a matter of business, as outsiders who have to deal with you should be informed of the change, as they may want to communicate with you on important matters.

Mr. J. M. Ashley has been appointed road foreman of engines on the Seaboard Air Line, with office at Savannah, Ga.

Mr. W. J. Harahan, formerly general manager of the Illinois Central, has been appointed fourth vice-president of the same road.

Mr. Thomas Nichols has been appointed foreman of the machine shops of the Baltimore & Ohio at Lorain, O., vice Mr. W. F. Ryan, resigned.

Mr. J. F. Robinson, general foreman of the Seaboard Air Line shops at Savannah, Ga., has been appointed acting master mechanic at that point.

Mr. A. J. Pool, master mechanic on the Seaboard Air Line, has been transferred as master mechanic on the same road from Savannah to Atlanta, Ga.

Mr. W. P. Sproul has been appointed master mechanic of the Atlantic Coast Line Railway, with office at Savannah, Ga., vice Mr. F. S. Anthony, resigned.

Mr. John Schillings has been appointed roundhouse foreman on the Houston & Texas Central at Hearne, Tex., vice Mr. J. J. Connor, promoted.

Mr. C. L. Nichols, has been appointed superintendent of the Southwest division of the Chicago Great Western Railway, vice Mr. C. P. Stembel, transferred.

Mr. M. J. Keating has been appointed traveling engineer on the Wisconsin division of the Chicago, St. Paul, Minneapolis & Omaha, vice Mr. J. J. O'Neil, promoted.

Mr. W. L. Kellogg, formerly master mechanic on the Missouri Pacific, has been appointed master mechanic of the Pere Marquette Railroad, with office at Grand Rapids, Mich.

Mr. J. J. Connor, roundhouse foreman of the Houston & Texas Central at Hearne, Tex., has been appointed general foreman of the company's shops at Houston, Tex.

Mr. A. C. Ridgway has been appointed general manager of the Denver & Rio Grande Railroad and of the Rio Grande Western Railway, with headquarters at Denver, Col.

Mr. Thomas F. Howley has been appointed general road foreman of engines on the New York and Delaware divisions of the Erie Railroad, with headquarters at Port Jervis, N. Y.

Mr. J. Cardell, heretofore master mechanic on the Canadian Pacific Railway at Winnepeg, Man., has been transferred as master mechanic to Calgary Atla. vice Mr. S. Phipps, transferred.

Mr. Williard Lincoln has been appointed Master Mechanic of the St. Paul and Minnesota Divisions of the Northern Pacific Railway, with office at Staples, Minn., vice H. M. Curry, promoted.

Mr. T. G. Averill, formerly Air Brake Instructor on the Boston & Maine, has been appointed traveling engineer of the Eastern and Western divisions of the same road, with headquarters at Boston, Mass.

Mr. O. Montanye has been appointed road foreman of engines on the New York, Susquehanna & Western Railroad. Mr. Montanye has been for more than thirty years in the employ of this company.

Mr. Samuel Millican has been appointed superintendent of motive power and machinery of the Houston, East & West Texas Railway, with headquarters at Houston, Texas, vice Mr. R. S. Tuggle, resigned.

Mr. J. C. Benson, formerly employed in the Havre shops of the Great Northern, has been appointed roundhouse foreman of the Glasgow, Mont., shops of the same road, vice Mr. G. E. Herren, assigned other duties.

Mr. S. T. Park, master mechanic of the Chicago & Eastern Illinois, has been appointed acting superintendent of motive power on the same road, with headquarters at Danville, Ill., vice Mr. G. W. Smith, resigned.

Mr. W. C. Bewley, formerly general foreman of the Wabash shops at Forrest, Ill., has been transferred to Delrey, Mich., in the same capacity by the same company, vice Mr. Eugene McCann, resigned on account of ill health.

Mr. W. F. Potter, president of the Long Island Railroad, has been prostrated for several weeks with a severe illness which gave his friends much uneasiness for several days, but we are pleased to learn that he is now slowly recovering.

Mr. H. M. Muchmore, formerly division foreman of the St. Louis & San Francisco at Fort Smith, Ark., has been appointed master mechanic of the Paris & Great Northern Railroad, with office at Paris, Texas, succeeding Mr. C. E. Boss.

Mr. C. H. Temple has been appointed master mechanic of the central division of the Canadian Pacific Railway, with headquarters at Winnipeg, Man. He had previously held the position of master mechanic on the Pacific division of the same road.

Mr. J. W. Higgins has been appointed assistant general manager in charge of transportation of the Missouri Pacific, the St. Louis Iron Mountain & Southern and the leased and operated lines. Mr. Higgins' office is in St. Louis, Mo.

Mr. C. I. Lewis has been appointed master mechanic of the Arizona & Colorado, the Cananea, Yaqui River & Pacific, the Maricopa & Phoenix and Salt River Valley, and the Gila Valley Globe & Northern railroads, with headquarters at Globe, Ariz.

Mr. S. Phipps, heretofore master mechanic on the Canadian Pacific Railway at Calgary Alta, has been transferred to the Pacific division in the same capacity by the same road, vice Mr. C. H. Temple, transferred. Headquarters at Revelstoke, B. C.

Hon. A. C. Killam, one of the judges of the Supreme Court of Canada, has been appointed by the Dominion government to be chairman of the Canadian Railway Commission, vice Hon. A. G. Blair, resigned. The headquarters of the commission is in Ottawa.

Mr. Robt. G. Long, roundhouse foreman on the Missouri Pacific at Fort Scott, Kan., has been promoted to the position of general foreman at the same point. Mr. Long is a very progressive and able mechanic, and will give a good account of himself in his new position.

Mr. J. J. O'Neil, formerly traveling engineer on the Wisconsin division of the Chicago, St. Paul, Minneapolis & Omaha, has been promoted to the position of assistant superintendent of the Minnesota division of the same road, with headquarters at St. James, Minn.

Mr. George E. Herren, formerly roundhouse foreman at Glasgow, Mont., on the Great Northern, has been appointed traveling engineer of the Montana division of the same road, vice Mr. W. W. Hurd, who has resumed his old run on the "flyer" from choice.

Mr. W. H. Stone, grand chief of the Brotherhood of Locomotive Engineers, recently took part in the organization of a new division of the B. of L. E. in Memphis, Tenn. Mr. Stone, while in that city, took occasion to call the attention of all concerned to the biennial convention of the Brotherhood, which is to be held in Memphis, in May, 1906.

Mr. F. Burke, who, for the past several years has served in the capacity of locomotive engineer on the Iowa Central, Rio Grande Western, Northern Pacific and the Duluth Missabe & Northern Railways, has been appointed traveling engineer for the last-named company, with headquarters at Proctor, Minn. His many friends will be pleased to note his appointment and offer congratulations.

Mr. H. M. Sperry, formerly New York agent for the Union Switch & Signal Company, has become consulting signal engineer of what is called the "Hudson Companies," of New York. This is the corporation which combined the Hudson river tunnnel, one tube of which is built, and the New York & Jersey Railroad. They will build all the Pennsylvania Railroad tunnels. and build the proposed Sixth avenue tunnel in New York, besides undertaking other similar enterprises.

Mr. A. Buchanan, Jr., has been appointed superintendent of motive power and car department of the Central Vermont Railroad, with headquarters at St. Albans, Vt., vice Mr. J. Coleman, resigned. The new superintendent of motive power is the son of Mr. A. Buchanan, a well-known engineer on the N. Y. C., and is nephew to Mr. William Buchanan, who for years held the important position of superintendent of motive power of the New York Central Railroad.

Mr. J. F. Deems, who is general superintendent of motive power of the New York Central, has also been appointed general superintendent of motive power, rolling stock and machinery of the Michigan Central Railroad, with office in New York. In addition to this extension of Mr. Deems' authority he has been appointed general superintendent of motive power, rolling stock and machinery of the Cleveland. Cincinnati, Chicago & St. Louis Railway. His office remains at the Grand Central Station, New York.

Mr. J. W. Hardy, formerly road foreman of engines on the Colorado Midland at Colorado City, Col., has been promoted to the office of master mechanic of the Denver & Rio Grande Railroad, with office at Grand Junction, Col. Mr. Hardy is well known in the mechanical world on account of his connection with the Air Brake Association and the Traveling Engineers' Association. Knowing Mr. Hardy's ability and hustling qualities, we predict for him a successful future and a further rise to higher positions.

Mr. E. B. Boye has been appointed manager of the Cleveland office of Manning, Maxwell & Moor. The office is located in the Williamson Block, Cleveland, Ohio. Mr. Boye has for the past five years been connected with the Chicago branch of this firm. He is well versed in, and thoroughly posted on, the various kinds of machine tools and their uses, and in his new position he will no doubt increase his already large acquaintance among machine tool users, and his opinions on such matters will be of benefit to those purchasing tools.

Mr. C. E. Gossett, formerly traveling engineer on the Chicago, Rock Island & Pacific, has been appointed master mechanic of the St. Louis line of the same road, with headquarters at Eldon, Mo. The position of traveling engineer has been abolished. Mr. Gossett entered the service of the Rock Island & Peoria in 1898 as a locomotive engineer. When this line was absorbed by the C. R. I. & P. in 1901 he was transferred to the main line, and in 1903 he was appointed road foreman of equipment of the Oklahoma division, with headquarters at Chickasha, I. T. In September, 1904, he was transferred to the W. El Paso division and later to the St. Louis division.

Throughout his official career President Roosevelt has always shown great kindness towards railroad men, and now we have new evidences of this sentiment in connection with the Panama Canal. The Board of Commissioners which he appointed have as a whole proved a failure and Chief Engineer Wallace, formerly General Manager of the Illinois Central, is the only member lileky to remain on a reorganized board. It is reported on good authority that the President intends to associate with Mr. Wallace, Mr. Horace G. Burt, formerly president of the Union Pacific Railroad, Mr. Samuel Felton, president of the Chicago & Alton, and Mr. L. F. Loree, formerly president of the Baltimore & Ohio Railroad. It would be difficult finding a finer group of railway men selected for distinguished positions.

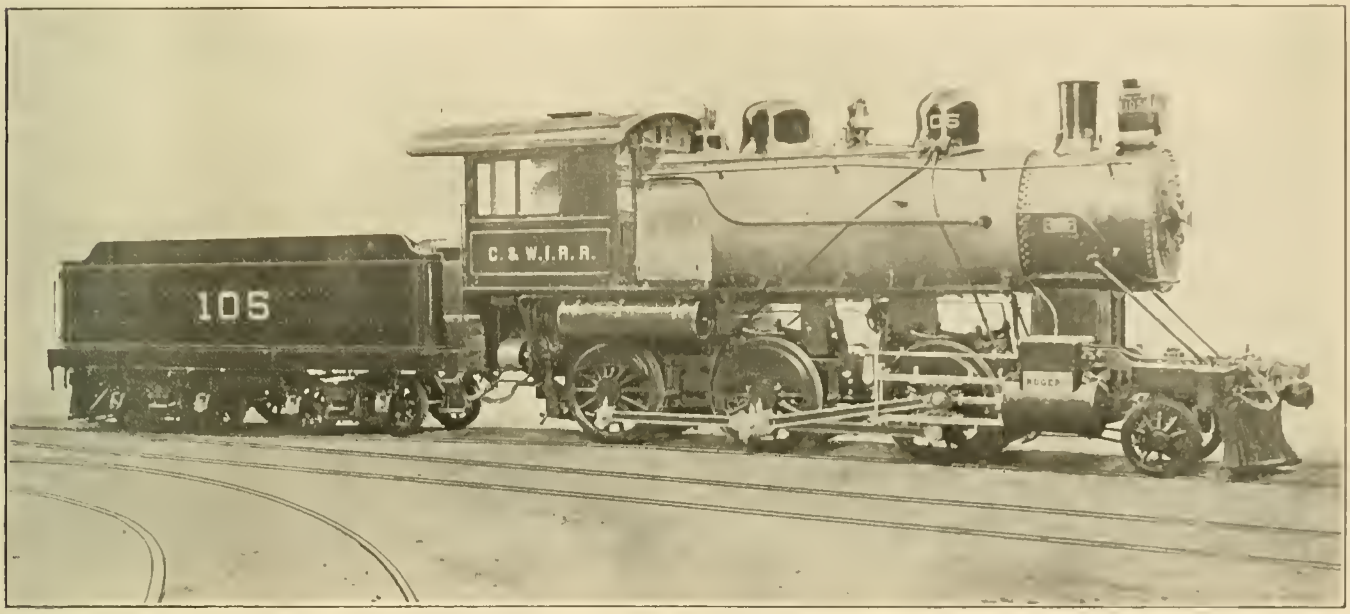
Mr. George W. Smith has left the Chicago & Eastern Illinois to become superintendent of machinery of the Missouri Pacific, with headquarters in St. Louis. We congratulate Mr. A. W. Sullivan, the general manager, on his good fortune in securing such an efficient man for the head of his machinery department. We have noted Mr. Smith's progress for over twenty-five years, and it has always been in the right direction. Every detail of railroad mechanical work is as clear to Mr. Smith as an open book. His lines have been cast in the hardest regions for the trying of railroad men's souls, and he always passed through deserving the crown of victory. A real master of his business, George Smtih has always been found treating those under him with the kindest consideration, and he has received cordial co-operation in return. We predict great success for him on the Missouri Pacific system.

Mr. Howard M. Curry has been appointed to the position of General Master Mechanic of the Northern Pacific, with office in St. Paul, Minn., vice Mr. S. W. Wheatley, resigned. Mr. Curry leaves the position of Division Master Mechanic at Staples to assume the higher responsibilities of a general officer. This promotion is one well earned by a strict attention to business, coupled with executive ability that seldom fails of recognition in railway service. His career has been marked by the vicissitudes of the pioneer engineer in freight and passenger service on the N. P., from which it was for him a logical step to the positions of traveling engineer and that of master mechanic, through which he has honorably passed while yet on the sunny side of middle life. His friends will join us in the wish that the upholstery of his office chair will be as comfortable as the seat box of the old 338.

From a blue print recently received showing the mechanical expenses of operating the Kansas City Southern Railway, we infer that Mr. W. E. Symons, superintendent of machinery, must have been hustling to some purpose to combine the impracticable feats of increasing the efficiency of the power while reducing expenses. The cost of running repairs was reduced from over 9 cents last year to 6.7 cents, and Mr. Symons expects to get the figure down to 6.5 cents, which will effect a saving of $137,000 for one year. While making the reduction mentioned an increased shop output from 28 to 71 per cent. in the number of locomotives repaired, and the reduction in the cost of repairs per engine has ranged from 14 to 23 per cent.

Senator Depew.

There was a move made by the more inferior class of New York politicians to defeat Senator Depew, but happily the move came to naught. The United States Senate could ill afford to lose a man like Dr. Depew. "Holland," the famous correspondent of the Cincinnati *Inquirer*, recently wrote the following estimate of Senator Depew: "When the Joint Traffic Association was organized Depew was unanimously chosen as its president. It was an extraordinary body of men who gathered around the table at the head of which Mr. Depew sat. There were President Roberts, of the Pennsylvania, a masterly engineer and a great financier; President King, of the Erie, an authority without superior upon railway traffic; President Spencer, of the Baltimore and Ohio, of wonderful keenness and unusual ability in succinct and lucid statements; President Fowler, of the Ontario and Western; Samuel Sloane, of the Lackawanna, and Maxwell, of the Jersey Central, together with that master mind in the field of railway construction and operation, Vice President Layng, of the West Shore. Each one of these had his specialty, but Depew, as he sat at the head of the table, was the specialist of all departments, and the only one that was. Sometimes they met charged with dynamite, and it was then that Depew revealed, first, his almost intuitive capacity to reach the very center of a problem and to solve it, and, then, a gift of doing that tactfully, so that all danger of explosion was removed. There is probably no man in the Federal Senate who better understands the delicacy, the difficulty, complexity, that are in the questions of railway rates; and as that is to be a commanding question before Congress it seems to railway men here as though Depew's services could be of the highest value if he were to remain in the Senate. But of his business career he has made little publicity, and it is only the greater men of railway affairs who understand it."



P. H. Peck, Master Mechanic. C. & W. I. 2-6-0 TYPE. Rogers Locomotive Works, Builders.

Chicago & Western Indiana Mogul.

Last month we illustrated a double-end tank locomotive for the Chicago & Western Indiana, built by the Rogers Locomotive Works, of Paterson, N. J. This month we are able to present our readers with the representation of a mogul locomotive built by the same concern for the same road.

The engine in question is a simple 2-6-0 machine, with 20x26 in. cylinders, and 57 ins. diameter driving wheels and with a boiler pressure of 200 lbs.; the calculated tractive effort is about 31,000 lbs. The weight on the drivers is 136,000 lbs., so that the ratio of tractive effort to adhesive weight is as 1 is to 4.3. The valves are balanced slide and they are actuated by ordinary indirect valve motion, the main driving wheels being the center pair. The driving wheels are equally spaced, being 7 ft. 6 ins. apart, thus giving a driving wheel base of 15 ft. All the wheels are flanged.

The boiler is an extension wagon top with radial staying for the crown sheet. The smoke box course is 64 ins. in diameter. The fire box has a grate area of 46¾ sq. ft. It is 102 ins. long by 66 ins. wide. The heating surface in the fire box amounts to 172.4 sq. ft., that of the flues is 2,239.5 sq. ft., making a total of 2,411.9 sq. ft. The flues are 329 in number, 2 ins. diameter, and 13 ft. long. The taper course is the second one, it slopes up to the waist, which is about 74¼ ins. This gives good steam space, and as the back sheet is perpendicular the maximum capacity is secured.

The tender trucks are of the arch-bar type with composite bolsters resting on eliptic springs with 33 in. wheels. The underframe is made of 10-in. steel channels and carries a tank having a capacity of 5,000 U. S. gallons of water and 8 tons of coal. The weight of engine and tender in working order is 102,700 lbs. A few of the principal dimensions are given below.

Driving Wheel Centers—Material, cast steel.
Driving Tires—Size, 3½x5½ ins.
Driving Axles—Material, steel; journals, 9x12 ins.
Total Wheel Base of Engine—23 ft. 6 ins.
Weight on Drivers—136,000 lbs.
Weight on Truck—21,000 lbs.
Weight Total—Engine, 157,000 lbs.
Boiler—Thickness of barrel, 11/16 in.; thickness of dome course, ¾ in.
Fire Box—Thickness, crown, 13/32 in.; thickness, flue sheet, ½ in.; thickness, sides, 11/32 in.; back, ⅜ in.
Engine Truck—Style, radial swing bolster. Wheels—Diameter, 33 ins.; kind, steel tired.
Tender—Weight in working order, 102,700 lbs. Wheels—Diameter, 33 ins.; kind, steel tired.
Safety Valves—Two 3 in. Lubricator—Triple sight feed. Headlight—16 ins. round case. Boiler Covering—Sectional magnesia. Cab—Material, ash.

Fourteen-Foot Grinding Machine.

The grinding machine which we here illustrate is a tool which can swing upon its centers material weighing as much as 7,000 lbs., and having a diameter of 18 ins. and may be 14 ft. long. It is only intended for heavy work and is made by the Norton Grinding Company, of Worcester, Mass.

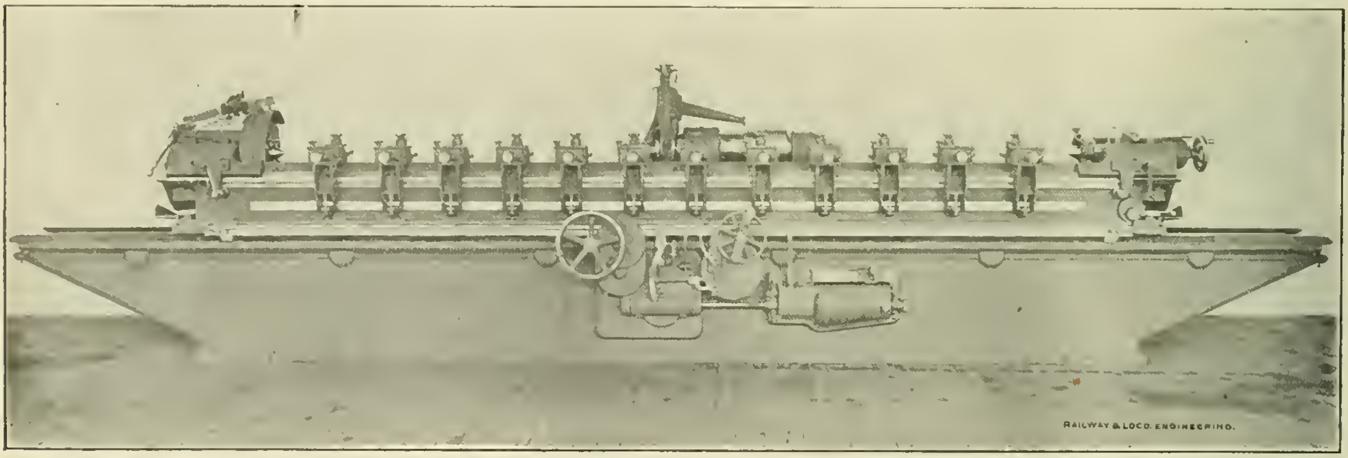
The advance of the grinder wheel is governed by positive indexing methods so that work may be reduced in diameter by the one-four-thousandth of an inch at a time or it may be made to remove one cubic inch of metal per minute.

The base of the machine is a single casting 22 ft. long and weighing about 10,000 lbs. The complete machine weighs 22,000 lbs., which is just 1,000 lbs. per lineal foot. The work is turned by means of a belt drive to the cone pulley in the head stock. The variation of speed is got by shifting the belt from step to step on the cone by means of a sliding shipper traversing an inclined guide.

The cone pulley has eight steps and as two speeds are provided, this gives sixteen speeds of rotation. The sliding ways of this machine are lubricated by oil rollers or small wheels in pockets.

The grinder wheel spindle and bearings are the same as those used on other machines (18x96 ins.) made by the company. The slide rests are one flat and one V-shaped groove. The great width of the ways smoothly carries the 1,400 lbs. of the slide, and the grinder gear, and at the same time insures perfect lubrication. There is a swivel table for grinding tapers up to 1½ ins. per foot. It is similar to those used on other Norton grinders.

The head and tail stocks together weigh about 400 lbs. There are seven universal and plain steady rests used on this machine. There is a center grinder supplied with this tool which is arranged to grind the center points of the head and tail stocks at an angle of 60 degrees. Water grinding compound is fed to the work at the rate of 35 gallons per minute. It is claimed by the manufacturers that this grinder will remove any desired amount of steel by intervals of diameter from one-four-thousandth to ten-one-thousandths of an inch, according to the area of the surface of the work.



NORTON GRINDING MACHINE, EXTRA LARGE SIZE.

Royalty on the "Head End."

Prince Ferdinand, of Bulgaria, is the only surviving child of Louis Philippe, once called King of the French. The son is a man who enjoys a swift ride in the cab of a locomotive. Not long ago when traveling via Calais to London with his suite he asked and received permission to ride on the engine of the Calais express.

When the train arrived at Abbeville, which is about 96 miles from Paris, he donned a pair of overalls and "jumper," left his private car and took a seat on the "left side." He did not "run" the engine, and the engineer did not take his eagle eye off the signals or the road ahead on account of his distinguished visitor.

The ruler of Bulgaria, however, was enthusiastic over his experience,and says it far surpasses riding in an automobile. "The mere thought," he said, "that hundreds of lives are at the mercy of the man holding the throttle thrills you." Prince Ferdinand on the "head end" just took chances like an ordinary man and fully enjoyed himself.

When he arrived at Paris people in the station were astonished to see a man climb down out of the cab and be met with much deference by the station master, a special commissary and a government official, who escorted him to an automobile. He was driven rapidly away still in the overalls, etc.

The newspaper accounts describe him as stepping from the cab with grimy face, black hands and blouse covered with grease. Now, if Prince Ferdinand got himself into such a condition on a 90 mile ride when he only sat still and did no work, it looks as if the oil famine had not taken hold as strongly in France as it has here.

Looks Like Poor Inspection.

A serious wreck recently occurred to a limited train on one of our trunk lines. The train was derailed on an embankment and plunged down the side about 20 ft. Fortunately no one was killed.

A press dispatch giving details of the affair, says the cause of the occurrence was that the auxiliary reservoir under the cab fell onto the track at a switch and fouled the front wheels of the tender, with the result that the train went over the embankment.

If this account is true, it looks as if poor inspection and neglect had been the primary cause of the run off. It is hardly reasonable to suppose that all the bolts holding up the reservoir were in thoroughly good condition, and that they all gave way together. It is for the purpose of investigating things of this kind, and that the findings of the investigators may be officially made public, that the Interstate Commerce Commission desire enlarged powers.

Engineer Burned to Death.

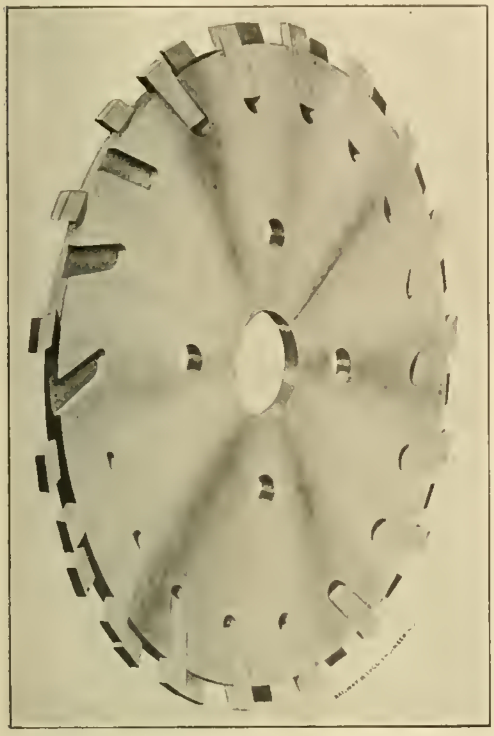
A most extraordinary accident happened one day last month to an engineer belonging to the New York Central Railroad. A local paper says:

The Adirondacks and Montreal Express, due in this city at 5:10 yesterday morning, was over an hour late. At Schenectady tower No. 9 Allen received an order to stop. It is thought that the accident was due to a failure on Allen's part to put on the blower while making the stop.

Allen's size made it impossible for him to jump out of the cab when a sheet of flame, followed by scalding steam, burst from the fire box. His body was horribly burned and he died soon afterwards at the hospital.

We are informed that the Independent Car Equipment Company of New York, is said to manufacture a rotary engine which can be applied to a 300,000 pound locomotive or to an 800 pound automobile. It is amazing how carefully such concerns manage to hide their light under a bushel.

One day last month a train loaded with locomotives for Japan left the Schenectady Locomotive Works. The shipment consisted of twelve mogul engines for use on the Kusin Railroad in Japan. Each of the cars bore huge banners with "Locomotive for Japan from the American Locomotive Company" inscribed thereon in letter of such size that a blind man could almost read.



TINDEL SAW FOR HEAVY CUTTING.

High Duty Cold Saw.

Our illustrations show the general appearance and saw detail of a metal sawing machine which has been designed by the Tindel-Morris Company for heavy duty and can be used for a great variety of operations.

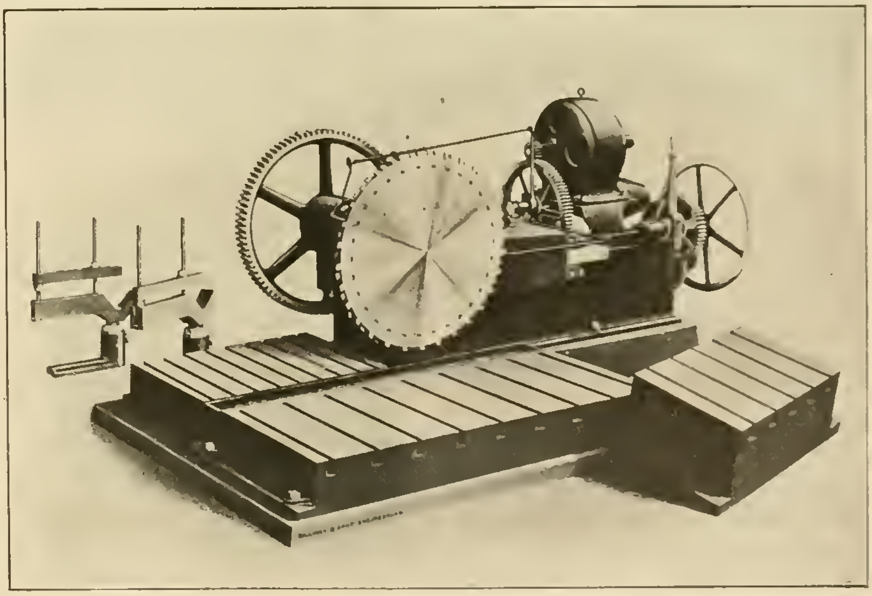
To begin with, the saw itself is made of a high carbon crucible steel plate, with teeth slots equally spaced in each side. The slots are so arranged that the resultant pressure on the teeth, when cutting, holds them securely in place, there being no pins or other fastenings to hold them. This allows for the easy and quick application or removal of the teeth.

The saw tooth itself is made of a special high grade air hardening tool steel, which ensures high speed and great endurance. The manufacturers inform us that one of these saws was employed in sawing high and low carbon steel for ten hours a day for three weeks in their own shops, and during that time the saw did not require to be removed for grinding, nor was a single tooth broken.

The whole machine is strongly and rigidly built, so that the saw may be worked right up to the economical limit. The teeth are "set" slightly away from the plane of the sides of the saw so that ample clearance is provided and nothing but the outer edges of the teeth touch the kerf. The lower end of the teeth and the blade disk are quite free. Friction losses are thus avoided.

The machines are geared for high power in both feeding mechanism and saw drive. In this machine the saw is advanced against the work. A good point in the construction of the machine is the solid square lock saddle, which gives the saw arbor the support of a rigid and substantial bed. The arbor bearings are solid and are carried in phosphor bronze adjustable bushings.

The gearing used throughout is steel, the teeth having been cut from the solid. The use of worm gear has been avoided in order to do away with excessive friction. The feed is secured by a heavy screw rotated by gearing driven from a six-step cone pulley. The range of feed covered in four intermediate steps is from 0.5 and 2 ins. per minute. The tool is substantial in every way, the details have been worked out with a view to simplicity and durability, and the tool is well worth the space it occupies on the floor of a modern railroad shop.



TINDEL HIGH DUTY COLD SAW.

From Trifles Light as Air.

Particulars of the minor income and expenditures are interesting and curious. Here are details about the Santa Fe System compiled for one year. There are 400 stations between Chicago and the Pacific coast that have slot machines containing gum. Into these machines last year were dropped 1,150,000 pennies, a total of $11,500.

The pins used by officials and employees of the Santa Fe System weighed 3,000 pounds. To keep the depots and offices clean 26,000 brooms were used. The lead pencils used, if placed end to end, would make a line 325 miles long. Fifty barrels of ink and 40,000 pens were used.

From what is known as the "scrap heap," the company realized last year $1,250,000. This included almost everything from a shingle nail to a wornout locomotive. Five thousand dollars was realized from the sale of waste paper.

High Points on Transcontinental Lines.

The highest point on the Grand Trunk Pacific will not be more than 3,000 ft. above sea level, and this will, of course, be in one of the mountain passes through the picturesque Rockies. The next lowest road is the Great Northern, with highest point 5,200 ft. The Canadian Pacific comes next with highest point 5,300 ft. The Northern Pacific reaches a height of 5,567. The Santa Fe, 7,600 ft., and the Union Pacific rises to 8,200 ft. It will thus be seen what an immense advantage in hauling freight the Grand Trunk Pacific has. Pulling cars up one side of a mountain grade and taking them down the other without really doing any useful work is always expensive railroading, and it makes a practical limit to traffic.

Our Interests in Corean Railways.

We do not know of any country that has come so rapidly into prominence in a few years as Corea has done since the war began between Russia and Japan. Corea is a peninsula much like the State of Florida, but has an area of 82,000 square miles, making it about one and a half times the size of Florida. The country is mountainous and densely wooded in some parts, but it is highly fertile, with immense natural resources that already maintain a population of over ten millions of people that are of the same race as the Chinese, but are developing on broader lines. The students of human development have found Corea a rich field for investigation, as there are tribes in the interior living under the communist system that followed the rule of the family head, or patriarchial system.

The trade and industrial development of Corea are progressing very rapidly and the indications are that the United States will enjoy a large share in providing the country with the implements and machinery necessary in developing civilization. United States Consul-General Paddock, stationed at Seoul, the capital of Corea, in a recent report, prophesies that a great development awaits this Oriental region, so little known two years ago. Some idea of Corea's foreign trade may be gained from the fact that the year 1903, though marked by only average agricultural conditions and bad cattle disease, showed an increase in foreign trade from $15,691,109 in 1902 to $19,585,168. Of this the exports of gold—of which Corea is a rich repository—amounted to $2,717,285. The increase in imports was relatively larger than in exports, showing an expansion of consuming capacity. Next to railroad materials, the largest item in the imports consisted of food stuffs, rice and other grains, including flour, nearly all the latter American. It is to be noticed that in Corea, as in China and Japan, the steady tendency is to increase the use of wheat food, though it will never displace rice as the dependence.

Corea's imports in 1903 of railway material amounted to $870,722. As the development of Corean railroads promises to go on rapidly, it is a matter of a good deal of importance to this country, as the equipment will be very largely by American manufacturers. The first road from Seoul to Chemulpo, built by an American in 1899, and equipped with American material and rolling stock, was sold to a Japanese company and was successful from the start. It is now owned by the Seoul-Fusan Company, also Japanese, which expects to complete a new line 268 miles long to Fusan. This will give quick communication with Japan. Another railroad from Seoul to Wiju, on the Yalu river, some 300 miles long, undertaken in 1902 by French concessionaires, has passed into the hands of the Japanese Government, which is finishing it. Another line from Seoul to Gensen, the eastern treaty port, is in stage of survey, and will be a permanent road. These present Japanese activities, though immediately animated by military needs, look in the end to exploitation of commerce and agriculture. Corea will thus be traversed north and south, east and west, with transportation lines. If the United States does not get the largest moiety of the equipment of these lines, which will run to $5,000,000 and more within a year or two, and thus drive a powerful opening wedge, it will be the fault of our manufacturers.

Wind Pressure Gauge as a Safety Appliance.

Some years ago the Furness Railway in Great Britain were unfortunate enough to have a mail train blown from the track by the fury of a winter gale. The train was thrown over the Levens viaduct and nearly fell into the sea.

With the idea of preventing the recurrence of a similar disaster the railway company installed an instrument which automatically warns the signal men stationed at Cark and at Plumpton when the wind pressure on the viaduct reaches the danger point.

The apparatus has been placed on the western side of the structure and is a wind pressure gauge with suitable recording apparatus. Not only is the wind pressure constantly recorded but the device has the further function of warning the signal men when the wind is too strong for the safe passage of trains. The warning is given by the automatic ringing of bells in the signal towers. The bell rings steadily as long as the dangerous velocity of the wind keeps up, and all traffic over the viaduct is absolutely stopped. When the bells cease ringing it indicates that the fury of the wind has subsided, and that traffic may be resumed with safety.

Pennsylvania Railroad Pension Allowances.

The statistics of the Pennsylvania Railroad Pension Department, compiled to December 31, 1904, show that during the five years of its operation there has been authorized to be paid in pension allowances to the retired employees of the company, the sum of $1,614,087.59, made up each year as follows: 1904, $390,000.00; 1903. $359,374.32; 1902, $328,403.10; 1901, $292,290.20; and 1900, $244,019.97.

The above expenditure does not include the expenses of operation of the department, which is also borne by the company.

During the five years' application of the pension plan 2,814 employees have been retired as pensioners from the active service of the company, of which number 700 have died. Of the total number retired 568 were between the age of 65 and 69 years, of whom 439 were retired on their own request with the approval of the employing officer.

While reflecting on the great good done by this department of the Pennsylvania Railroad we cannot help regretting that other companies do not follow the benevolent example. There is a splendid opportunity for the Vanderbilt lines to advertise themselves as benignant employers of labor. Railroad companies and others that have followed the policy of caring for their old and faithful employees have found that the money so spent is the best kind of investment in developing the loyalty that holds down the operating expenses.

Car Roofs.

Most wooden car roofing is thoroughly kiln dried, and if laid close will buckle in the first rain, allowing cinders, etc., to accumulate between the courses, causing leaks. This, in effect, is what the committee on car roofs told the North-West Railway Club not long ago. This is one among many reasons why the wooden roof is being gradually replaced by the plastic felt or the metal roof.

The club committee also stated that the number of cars on railroad repair tracks for bad roofs is sufficient to warrant a more systematic and detailed investigation than they had been able to give. The cost of repairs to wooden roofs is high enough to justify a larger initial expenditure by railways, if by so doing they could keep down this maintenance charge.

When repairs to wooden roofs have to be made, running boards should be raised and roof boards fitted close together at the ridge. Sometimes car repairers endeavor to drive roof boards up under running boards with the result that they often leave from one to two inches open at the ridge and heavy rains will drive and soak in and find such spaces, and so produce a leaky roof. Another point about such repairs is that brackets for running boards should be laid over the carlines and nailed through. When these brackets are laid between the carlines the nails will come through the roof boards and so produce leaks.

In speaking of the plastic felt roof, the committee recommended that in applying it to old cars the first course of roofing should be thoroughly cleaned and renailed, before the plastic material be applied. The upper course should be nailed only at ridge and plate. Nailing in middle ribs is not recommended. Regarding the inside metal-sub-carline type of roof, the committee said that in their experience the corrugated plates have a tendency to draw away from the ridge. One of the disadvantages of the inside metal roof is that it cannot be properly inspected from the outside, and leaks, after being reported, are hard to discover.

The outside metal roof seems to give fairly good results, but the type referred to is the kind which is held at the ridge and at the plate with small malleable iron clamps. The clamps have to be constantly replaced, which is a source of expense and annoyance. With any metal roof shrinkage of the car or distortion of the frame should be expected and the roof should be designed so as to minimize the tendency to leak under these circumstances. The committee believes that the pitch of the roofs of many cars might, with advantage, be increased. The committee further frankly stated that no roof now on the market was entirely and completely satisfactory and that as a committee they were not prepared to say which roof is the best.

Too Healthy to Be Chloroformed.

There is an engine on the Texas & Pacific which has been sent to the shops for a general overhaul. The engineer did not ask that the engine be shopped and the engine itself never said a word about "overhaul," as engines often do by breaking down, or going lame in some way or other.

This machine and the engineer, Mr. William Miller, seem to have been "stayers," if the six years' continuous service which No. 302 gave to the company count for anything. When ordered to see what the inside of the "back shop" looks like was received by the engine she was running as usual, and she is no doubt wondering if anything will be found wrong. On the other hand, the company think, that like the man who would not take salt with a boiled egg, he ought to be made to; and they want to make 302 take some back shop salt on general principles, after all these years. No matter how it turns out, the engine, the engineer and the railway are to be congratulated on the all-around good road performance achieved.

A Southern Switcher.

The Southern Railway recently bought some six-wheel switching engines from the American Locomotive Company. The engines were turned out of the Pittsburgh shops of that company.

The cylinders are 20x26 ins. and the engines are simple. The driving wheels are 50 ins. in diameter. The calculated tractive effort is about 32,000 lbs., and with 143,200 lbs. on the drivers, it gives a ratio of tractive effort to adhesive weight as 1 is to 4.47. The valves are the ordinary Richardson balanced slide and they are actuated by indirect valve motion. The valves are set with 1/16 in. lead and the travel of the valves is 5⅝ ins. The steam lap is 1 in., with no exhaust lap. The engine is very neatly proportioned with roomy cab, a front and a back sand box and the main reservoir carried under the running board. The air pump is carried on the left side.

The heating surface is 2,486½ sq. ft. in all. The fire box gives 110½ and the tubes furnish 2,376 sq. ft. The grate area is 29 sq. ft. The boiler is of the extension wagon top type, with a 63 in. course at the smoke box end. The fire box extends out over the frames and is nearly square, being 65⅛ ins. long and 65¼ ins. wide. There are 300 tubes in the boiler, each 15 ft. 1½ ins. long.

The tender is a slope-back one with rear head light and hand rail; it is mounted on a steel channel underframe and the tank has a water capacity of 4,000 U. S. gallons and 7 tons of coal. The total wheel base for engine and tender is 43 ft. 7¼ ins., and the total weight of engine and tender in working order is 233,500 lbs. The delivery pipe for the injector has a Y leading a branch pipe below the running board. Suitable stop cocks are arranged so that for fire fighting purposes the flow to the top check could be shut off and a hose applied to the branch pipe so that in case of a small fire anywhere through the yard the Southern switcher could give a good account of herself.

A. Stewart, Mechanical Superintendent. SIX-WHEEL SWITCHER ON THE SOUTHERN. American Locomotive Works, Builders.

It Pays to Advertise.

The Joseph Dixon Crucible Company, of Jersey City, N. J., print a monthly sheet which they call *Graphite*. In the March issue is a reprint of a story from the *Los Angeles County Press*, in which the well-known and oft-repeated truism, that it pays to advertise, gained new strength. Here is what the *Press* says:

"When a man gets into trouble he should always 'holler.' The editor of the *Press* sat down to write an item the other day and the pencil broke. He whittled it off and started again.

Another break! Then he used a pencil sharpener. Then the miserable lead crumbled. At last we got a point on the lead and sailed in. But a grain of sand or something as hard, prevented the pencil from 'taking hold.' Forthwith we grasped a pen and laid the whole case before the Joseph Dixon Crucible Company, of Jersey City, N. J. In other words, we threw ourselves on the mercy of the court.

"We explained through burning tears that if they made the kind of pencil we required to hustle 'em on by fast freight; and behold, on New Year morning they reached us, a big bundle, too! What a blessing! Just note the improvement in the *Press* henceforth! Once more we're happy! But the biggest joke of it all is that these same blessed pencils may be had right here in Long Beach and Compton, but we didn't know a solitary thing about it. It pays to advertise. Selah."

(And for Long Beach and Compton you may substitute the name of any town or village in the country where there's a stationery store.)

First Refrigerator Car.

The city of Columbus, Ohio, according to a local paper, claims that the first refrigerator car was built within its borders. The Columbus *Journal*, in an interview with Mr. Henry Frillman, obtained some interesting facts concerning the first attempts to make what has afterwards developed into Private Line Cars.

In 1871 the brewers and wine growers of Ohio celebrated their exemption from the provisions of a certain law by having a banquet. Mr. Frillman, the bookkeeper for the Gill Car and Car Wheel Company of Columbus, was at the banquet. In course of conversation with a leading Cincinnati brewer, Mr. Muhlhauser by name, the bookkeeper of the car company was told that if beer could be kept at a low temperature in transit, a large amount of it could be shipped to the South.

Mr. Frillman, having in mind some special poultry and egg cars which his company were building, with double sides, said he thought a car could be designed to handle the beer traffic. An order was soon given by the Cincinnati brewer for two cars with double sides, and a tank at each end, which latter had been suggested by Mr. Frillman. These two "refrigerator" cars were not to exceed $1,600. The car builders' master mechanic suggested some further details and the cars were built and were duly delivered in Cincinnati. They were put into service one hot August day, and loaded with beer for Memphis, Tenn. The popular beverage reached its destination with only a rise of two degrees of temperature, and the venture was pronounced a success.

The idea was never patented, as the proprietor of the car building establishment believed that there was nothing to patent. The cars he said were simply double side cars, and there was nothing remarkable about that. Not long after this when the thing became known the Barney & Smith people of Dayton, Ohio, were engaged in building hundreds of such cars, and the patent office received no application. The Gill Car Company, with whom the idea originated, only built a few, and did not get rich on refrigerator cars, but they conferred upon Columbus the distinction of being the birthplace of the refrigerator car, the modern descendant of which we all know so well.

No Change on the Pennsylvania.

The publications of rumors that bring reflections on any person's good name ought to be avoided unless some principle is involved and the demand for silence is more imperative when the reputation of a great body of men is concerned. These reflections passed through our mind when we read the following article in the Buffalo *Express:*

"An important change in the civil service rules which have been in effect for years on the Pennsylvania system probably will be made at the next meeting of the Board of Directors. One of these rules is that the company will not hire locomotive engineers from other railroads, but will promote its own men. The effect has been to make engineers and firemen feel assured of life positions, and, as a result, they have grown careless and less amenable to discipline.

"The managers of the Pennsylvania have reached the conclusion that the wrecks due to carelessness of engineers must be stopped and that the remedy lies in getting engineers from other roads to fill the places of careless and incompetent men who are now protected by civil-service rules."

That was such an extraordinary decision on the part of a concern like the Pennsylvania Railroad Company that we felt in duty bound to investigate the statement, and we did so thoroughly. We are gratified to be able to say on the best authority that there is not a word of truth in the article. The Pennsylvania people have an unusually efficient and capable corps of trainmen, and their good and faithful service is appreciated by the higher officials. Punishing all the employees for the faults or shortcomings of a few has never been the Pennsylvania way of doing business, and they are not now going to retrograde into a bad practice that has always resulted in demoralization whenever tried.

On the 5th of April the American Railway Association will hold their annual meeting in this city. Mr. W. F. Allen, 24 Park Place, New York, is the secretary of the association.

Slip Mail Vans.

The Great Western Railway of England have lately introduced some detachable post-office cars which they call slip mail vans. These vehicles are the largest of their kind in the United Kingdom, and this is the first time that slipping apparatus has been put on this class of railway equipment.

These vans, or as we should say, these cars, are 68 ft. long, or a trifle over 71 ft. over buffers, and are 9 ft. 6 ins. wide. They are spoken of as the "Ocean Mail" rolling stock. There are three types of coaches used in this service. The slip coach is divided into two compartments, one the guard's slip compartment and that for the letter sorters'; which gives room for fourteen men to work. The second type is the stowage van and is intended for the reception of sealed mail bags, and as many as 700 bags can be carried. The third type is a combined storage van with a compartment for a guard. This latter is smaller than the other two.

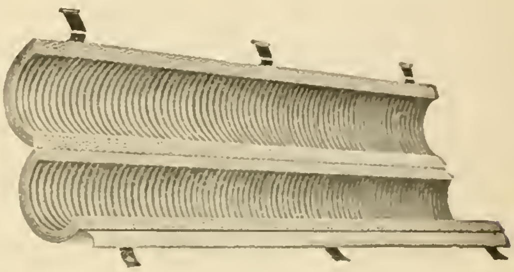
All the vehicles are arranged with wide gangways which permit the postal clerks to bring bags from the stowage vans to the sorting compartment. These mail vans are used for the conveyance of foreign mail from Plymouth to the North of England and they are "slipped" from the mail train at Bristol on the up country run. The use of these three specially constructed mail vans dispenses with the use of the separate guard's van formerly used.

The practice of slipping coaches is not new in the British Isles, though this is the first example where the postal service has got the benefit of it. These three cars are placed at the rear of the train, and the slipping consists of working a coupler which will "let go" when the guard desires to uncouple the cars without stopping the train. As the train approaches Bristol the guard in the head end of the three coaches detaches them from the flying train, and they are then braked so as to stop on the siding set apart for them some minutes after the train has passed through the station. Time and power are saved in this way, through the whole performance resembles what we in this country call making a flying switch.

The Duff Manufacturing Company, of Pittsburgh, Pa., have received another contract for a large number of Barrett Track Jacks, for the Government Railways of Russia. This is the third contract received from this source within the year by the Duff Company, and shows that the Barrett Jacks have been adopted by the Russian Government for their railroad work. It will be remembered that the first consignment of Barrett Track Jacks was to cover the requirements of the Siberian Railway and it was rushed forward to facilitate the government in preparing that road for the transportation of troops to the seat of war. At the time this contract was announced, it was regarded as an important award, in that it showed, contrary to reports, that Russia was willing to buy American goods. The Duff Company have also supplied Barrett Track Jacks to Japanese Railways and it was a marked coincidence at the time, that on the same day the first Russian contract was received, a large consignment of Barrett Jacks was ordered by Japan.

Sectional Pipe Covering.

The evolution of pipe covering from the days when sheets of asbestos paper were wrapped separately and tightly around pipes and secured with strings or bands up to the modern method, is an interesting subject. Undoubtedly, insulation resulted from the old method, but the covering thus applied



ASBESTOCEL FIRE-PROOF SECTIONAL PIPE COVERING.

did not effect the entrapping of air, and holding it stagnant. This inefficiency was met by the invention of concentric cell pipe covering. This consists of several layers of corrugated asbestos paper, placed so that the corrugations run concentrically around the pipe. Each channel, therefore, forms a closed loop, in which the air is effectually imprisoned. These circumferential channels occur between each of the several layers. The structure partakes of the principle of the arch and thereby is exceedingly strong and will withstand pressure and abrasion. It comprises practically all of the insulating properties which are to be found in asbestos.

This pipe covering will be found efficient on steam pipes carrying a pressure of 100 lbs. or less. This corrugated form of construction not only gives good insulation, but the covering itself is stiffer and capable of withstanding hard usage incident to the contraction and vibration of steam pipes. This material, which is called "Asbestocel," is a product of the H. W. Johns-Manville Co., 100 William street, New York. It is also manufactured in sheets, which are adapted to all classes of heat-resisting and heat-retaining work, such as for steam boilers, flues, shaft ways, ceilings, etc. It is also made up as a fireproof paper, with the combined properties of felt, asbestos and the imprisoned air, thus making a fireproof insulator, which can be used for wrapping heater pipes, lining floors, etc. The company will be pleased to go into fuller details with anyone interested.

Copper Pocket Money.

In that curious book, "Sartor Resartus," written by Thomas Carlyle, the author puts this passage into the mouth of one of the principal characters, from whose lips flow many words of wisdom. Speaking of his poor old incompetent schoolmaster, Herr Teufelsdröckh says: "He pronounced me a genius fit for the learned professions. * * * Meanwhile what printed thing soever I could meet with I read. My very copper pocket money I laid out on stall-literature; which, as it accumulated, I with my own hands sewed into volumes."

The young man at the present time is much better off than this Carlylean character, even if some schoolmaster has not thought him cut out for the learned professions. The modern young man has not to hunt over miscellaneous stall-literature in search of what he wants, nor has he to sew scattered leaves into volumes. He can look at any of the many literary guide posts along his way and be directed to the kind of reading matter which will supply him with just what he wants, and the book will already be bound and fully illustrated. The idea of diligently reading is as necessary to-day as it was when Carlyle wrote his book. Look over our list and see if you could not expend your copper pocket money to advantage and make substantial progress.

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and children see it.

"Twentieth Century Locomotives," Angus Sinclair Co., deals comprehensively with the design, construction, repairing and operating of locomotives and railway machinery. First principles are explained. Steam and motive power is dealt with; workshop operations described, valve motion, care and management of locomotive boilers, operating locomotives, road repairs to engines, blows, pounds in simple and compound engines; how to calculate power, train resistance, resistances on grades, etc. Shop tools explained. Shop receipts, definitions of technical terms, tables, etc. Descriptions and dimensions of the various types of standard locomotives. The book is well and clearly illustrated and is thoroughly up to date in all particulars, fully indexed. Price, $3.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." Price, $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. We sell it for 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. It sells for 75 cents.

The 1904 Air Brake Catechism. Conger. Convenient size, 202 pages, well illustrated. Up-to-date information concerning the whole air brake problem, in question and answer form. Instructs on the operation of the Westinghouse and the New York Air Brakes, and has a list of examination questions for enginemen and trainmen. Bound only in cloth. Price, $1.00.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion, it is easily understood by every intelligent fireman. The price is 50 cents.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable, and, best of all, they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Standard Train Rules." This is the code of train rules prepared by the American Railway Association for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotive, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

Railway and Locomotive Engineering. Bound volumes. $3.00.

Sir John Brown, who made the first rolled armor plates for modern battleships, was but a lad of sixteen when the sight of a carriage worked by a spiral spring at a village fair suggested to him the conical spring buffer for railway trucks, out of which, after a long struggle, he ultimately made a fortune.

The Noiseless Car Wheel Company has been incorporated in New Jersey. The denizens of elevated railroad districts are fervently praying that the noiseless wheel may make itself heard with furious success.

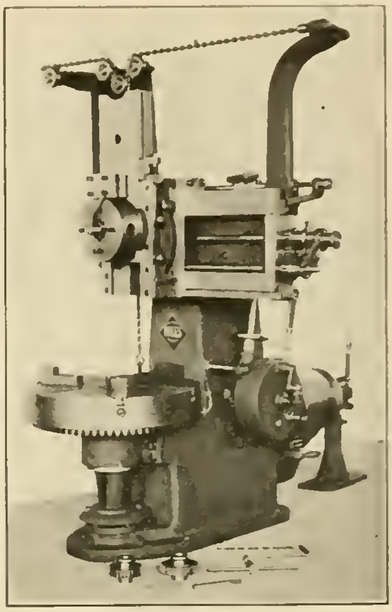
Keep yourself cool and equal to anything that may happen, and it will be the better for you.—*Bleak House.*

Turret Boring and Turning Mill.

The machine here illustrated is called a turret boring and turning mill; it is practically a lathe standing on one end so that the face plate has become horizontal. The tool is very substantially built and it is good for all sorts of boring and turning operations for work up to 30 ins. diameter.

The Niles-Bement-Pond Company, of New York, are the makers, and the machine has been designed for the purpose of using high duty steels, and the automatic feed stops, quick change positive gear feeds and easily handled back gearing which it possesses make it a very useful and satisfactory tool in a railway machine shop.

The table will take work 31 ins. in the rough and 15 ins. high. It has sixteen changes of speed, ranging from 4.6 to 130 revolutions per minute. The



TURRET BORING AND TURNING MILL.

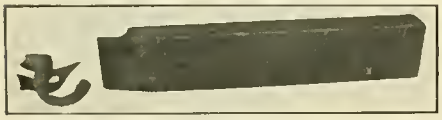
head is counterbalanced in such a way as not to interfere with the swiveling of the turret slide. The gearing is steel and is well proportioned and strongly made.

The advantage of the boring mill idea as applied to what is to all intents and purposes a lathe, is that work is much more easily handled on a horizontal face plate than it can be on a vertical one. The work does not require to be held in place by a crane or by a helper while it is being centered. It can be placed on the boring table by the man in charge and he may set it approximately in the center, and by the closing of the jaws of the universal chuck it is at once centered and is ready for boring, turning or facing, as the case may be, and no time is lost getting things ready.

The turret attachment on this machine is a time saver in the various operations required, just as much as it is on a lathe. There are four sockets for boring bars, and these are easily manipulated by the handle at the center of the turret. After work has been set the whole turret and head may be quickly slid over to one side of the work and the operation becomes one of turning. The general handiness of the tool and the ease with which it can be manipulated must commend it to all. One of these machines recently was run at a cutting speed of 155 ft. per minute and took in all 5¼ hours to bore 50 brass bushings 8¼ ins. high and 4½ ins. internal diameter. A roughing and finishing cut were run through each.

Test for Air Hardening Steels.

An interesting test was made at the St. Louis Purchase Exhibition of the McInnes Steel Company's product, and that of two other concerns. The judges were Messrs. C. D. Young, mechanical engineer of the Pennsylvania; J. W. Gallager, master mechanic of the Delaware, Lackawanna & Western, and J. L. Replogle, superintendent of the forge and axle department of the Cambria Steel Company.



McINNES AIR HARDENING TOOL STEEL.

The tests were made on a rough steel casting 12⅛ ins. diameter made by the American Steel Foundry Company. The composition of this casting was carbon .26, manganese .69, phosphorus .032, silicon, .304, and sulphur .022. The work was done on a 30 in. Putnam lathe, driven by an electric motor with a rated capacity of 25 h.p., 220 volts, 110 amperes, 600 to 1,200 revolutions per minute. All the tools were ground with 8 deg. rake; 8 deg. shere, and 6 deg. clearance.

The following is the summary of the report made by those conducting the test:

"We, the judges, having in charge the test of high speed steels held in Block 9, Machinery Hall, at the Louisiana Purchase Exposition on the twelfth day of September, 1904, do hereby certify that after an exhaustive test of the steels submitted in competition, we awarded the the first prize to McInnes Extra Air Hard Steel, manufactured by the McInnes Steel Company, Limited, of Corry, Pa., and that the details of the test and the results obtained are fully set forth in the official report made by us. Chas. D. Young, J. L. Replogle, J. W. Gallager."

"Compressed Facts About Compressed Air," is the title of a booklet by the Clayton Air Compressor Works, of 114 Liberty street, New York City, giving "a resume of the points to be considered in buying an air compressor of medium capacity." After an introductory quotation from Andrew Carnegie, that "A small saving in each process means fortune," brief chapters are devoted to the following topics: "Economy of Compressed Air," "Features of a Money-Saving Air Compressor," "How These Features are Combined in a Good and Medium-Priced Machine," "Method of Driving Air Compressors," and "Some of the Uses of Compressed Air." It is worthy of note that under the last are enumerated 139 distinct applications of compressed air and the list is by no means exhaustive. Illustrations showing some type of compressor or part thereof adorn every page and the pamphlet is printed on a high-grade of India tint paper and bound in blue and gold. It contains 32 pages and is standard in size, measuring 3½x6 ins.

A very handy little supplement to the Car Interchange Manual has been sent to us by the McConway & Torley Company, of Pittsburgh, Pa. The supplement is the right size to fit in the Manual and the edge is gummed so that you can put it in for keeps. In it cases 668 to 682, inclusive, are given in short form, but embodying all the essentials of the decision rendered by the Arbitration Committee of the M. C. B. Association. The Manual itself for 1905 contains a brief record of all the cases from 1 to 682, thus including the supplement which is intended to go with the 1904 Manual. In the back are useful data for the car man and others and some plain rules for first aid to the injured. The book can be had for 25 cents, on application to the firm who issues it. The McConway & Torley Company, it will be remembered, are the makers of the Janney Coupler, the Kelso Coupler and other well-known railroad specialties.

A most artistic publication has come to us with the compliments of the passenger department of the Southern Railway, and we may say that the passenger department of that road will gladly send a copy to anyone who would care to have it. Mr. W. H. Tayloe is general passenger agent, and his address is Washington, D. C. The pamphlet is called "The Land of the Sky," and a quotation from the Bible is used to describe a portion of the country through which the Southern runs. Those who care to turn to the pages of sacred writ will find the quotation in Deut. viii; 7, 8, 9. The Land of the Sky is that portion of Western North Carolina lying between the Blue Ridge mountains and the Iron, Smoky and Unaka ranges of Eastern Tennessee.

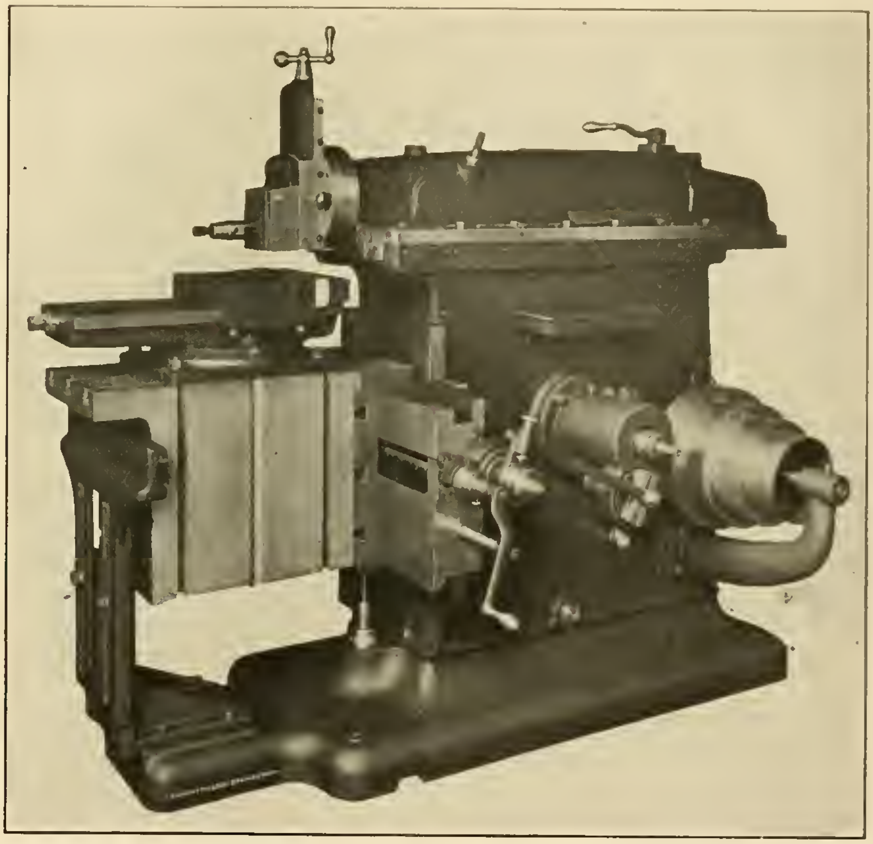
The half-tones throughout are excellent and are beautifully printed on plate paper. An artistic border of blue surrounds the letter press and the initial letter of each paragraph is centered on an azure square. The photographs from which the illustrations have been made are all beautiful bits of scenery, and many of them printed in blue and black are reproductions of bold and striking views along the railway line. Not only does the little book contain a lot of useful information but it is in fact a sort of souvenir which would be welcome anywhere.

Back Geared Crank Shaper.

This 24-in. back geared crank shaper is a very substantial machine. The column is of large proportions and is reinforced at certain points to resist working strain. The bearing for the ram is 40x11 ins., with overhang in the front to give the tool increased stiffness.

The ram design is of arch form, which brings maximum section of metal when the cutting tool is in its extreme position. The cross traverse of the table is 30 ins. and the screw has a graduated collar. There is a cam at this point providing for rapid change of feeds, without stopping the machine. The vertical adjustment is effected by means of beveled gears. An improved telescope screw is used which does not require a hole to be cut in the floor for it. The rocker arm is connected to the ram by means of a link, giving a straight pull and an even cutting speed, with quick return.

All the flat wearing surfaces are scraped to a standard surface plate. They are in all cases as wide as they can be made and so gibbed as to permit of close adjustment for wear. All column holes are long and they are bushed, thus providing for maintenance of original centers. All pinions, bevel gears and vise-jaw plates are of steel. Gears and T-slots are cut from solid stock. The vise is of the planer type and will hold solid or straight as well as angle cuts. The base can be firmly bolted to the table and the swivel is held to the base by two steel planer head bolts.



TWENTY-FOUR INCH BACK GEARED CRANK SHAPER.

The entire machine is carefully designed, solid and durable. Each machine is belted up and tested before leaving the works of the makers, the Queen City Machine Tool Company, who guarantee this shaper.

The Newport News Chamber of Commerce is making strenuous efforts to have the new car works of the Chesapeake & Ohio Railway located at that place.

It is well that a man should say what he has to say in good order and sequence; but the main thing is to say it truly.—*Ruskin.*

Locomotive and Train Handling.

Speaking of engineers who intelligently book the work required on their engines so that a fitter knows at once what to do, Mr. Walter S. Blyth says they are worth more money to the company than the men who do not. He argues that such men will do all their work with intelligence, and that as a rule they will have good firemen.

The substance of these remarks occurs in a paper read before the Canadian Railway Club by Mr. Blyth, traveling engineer of the Canada Atlantic Railway. Such a man as has been described will teach his fireman how to do his work in a workmanlike manner, and when the fireman comes to be promoted he will be a better man than the one who gets his training from the other fellow. Engineers have much influence over their firemen, and where harmony exists between the two the best results are obtained.

An engineer should work his engine to the best advantage and get steam and handle his engine as economically as his fellow engineer does with similar conditions prevailing. He should be able to locate any defect in the locomotive, whether simple or compound, and should be sufficiently familiar with the air brake system to locate any defects therein.

The sucessful engineer usually handles an engine by sound and speed, and, after opening the throttle, practice tells him when to shorten the cut-off. Locomotive valves are not always set alike and we may find some that will clear themselves of steam "hooked up" full with a full throttle, while others seem to choke, and the throttle must be eased off a little or the reverse lever lowered a notch in the quadrant.

The speaker said he believed that it pays best to run an engine where it works best, either with throttle or reverse lever. Running successfully is only part of an engineer's duty, and it is just as important to stop a fast-moving train as to get it in motion. An engineer should also be a good air brakeman.

In taking charge of a locomotive on the Canada Atlantic the men are instructed to start the air pump slowly with drip cocks open, and to run it slowly until a pressure of at least 20 lbs. is in the main reservoir. While the pump is running slow oil the air end by putting in a small quantity of valve oil in the oil cup and open the cup on the downward stroke. This will spray the oil on the walls of the cylinder. The men are instructed to apply the brakes and leave them applied when coupling up until the hose bags are coupled, releasing brakes by going to full release position. This relieves the brake gear from the shock caused by the sudden opening of the angle cock.

When an engine is started from any point on the road with a load the fireman should have his fire clean and in good order, so that when steam is being used at full stroke the boiler will generate it as fast as the engine uses it. When starting he should be guided by the effect of the exhaust on the fire and endeavor to maintain the fire as heavy as is required by the load which is being pulled.

When the fire is banked or lumpy it can sometimes be brought to its proper level by firing the coal to the bright places. The successful fireman does not make steam to blow off through the pops. He watches when the engineer is working the engine and fires light or heavy according to the work being performed. He will always keep in touch with the engineer and will know when and where he is going to shut off steam. He will either allow water to drop a little in the glass so as to keep the injector working, or he will allow his fire to cool off a little so that popping will be prevented. A good fireman will open the blower valve when the engineer shuts off. This prevents the unconsumed gases from being drawn into the steam chests and cylinders and it prevents these gases from annoying passengers when windows and ventilators are open.

An interesting and useful catalogue has recently come to our office which has been got out by H. B. Underwood & Co., of 1025 Hamilton street, Philadelphia. The catalogue is standard railway publication size and is well printed and illustrated and is concerned entirely with portable tools for railway repair shops. That department of the Underwood enterprise is now in charge of Mr. D. W. Pedrick, formerly of the Pedrick & Ayer Company. Mr. Pedrick has for years been active in designing and building such tools as are here set forth. The index on the first two pages shows forty-six portable tools and attachments which are part of the equipment of any up-to-date railroad repair shop. The advantage of this catalogue is that all these appliances are represented between the covers of one handy pamphlet, which can be used as a ready reference not only to see what portable tools there are on the market, but can be used as an aid in ordering parts. H. B. Underwood & Co. will be pleased to send a copy of this catalogue to anyone who writes to them for one.

Preferment goes by letter and affection,
Not by the old gradation, where each second
Stood heir to the first.—*Shakespeare.*

The Crane Company, of Chicago, publish a very tastefully arranged sheet which they call "The Valve World." The March issue has just come to our office, and on the cover we see a representation of the company's new Spokane, Wash., branch. A number of interesting articles and information about the Crane valves, pipe fittings, etc., are to be found on the pages of this publication. Some interesting trade notes are also given, and a few humorous paragraphs have been scattred through the reading matter, and the illustrations are good. If you would like a copy, write to the Crane Company, Chicago.

New Type of Boring Mill.

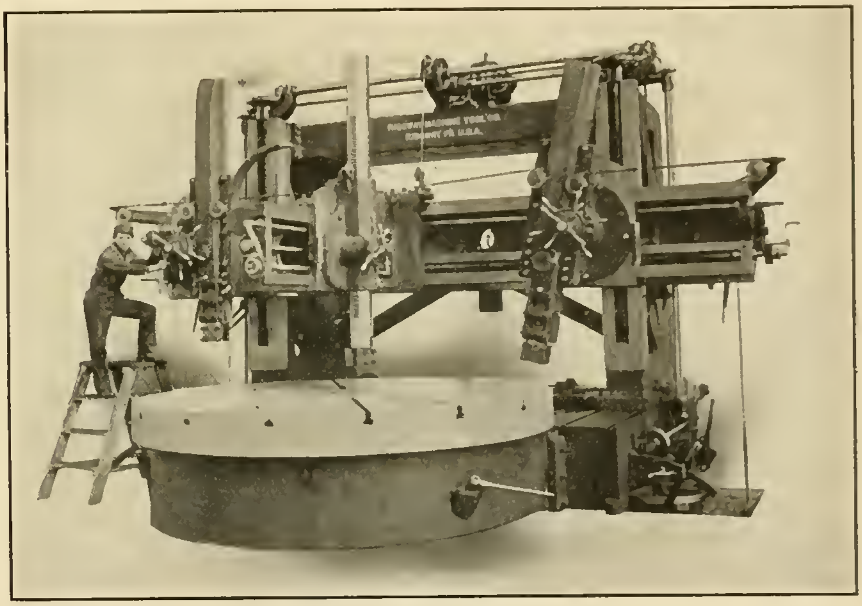
We are able to present to our readers some illustrations of a new boring mill made by the Ridgeway Machine Tool Company. The dimensions of the machine are large and the design has embodied features which give it great strength and solidity.

The opening over the table is 5 ft. 2 ins. measured from table to tool holder. The mill is of the extension type and in the forward position will swing 10 ft. 8 ins., and with the housings run back as far as they will go the swing is 16 ft. 4 ins.

The side view shows the method of bracing with the X-brace between the housings at the back. The flat top brace also between the housings is more than usually substantial and carries a small electric motor used for traversing the heads on the cross rail. The side bracing which is part of the housings themselves is heavy and so disposed as to effectively meet the strains put upon the tool in the various operations. There is an extension arm also shifted by the traversing motor, and it is of such a length as to permit facing to the center when the housings are run back to their extreme position.

The diameter of the table is 10 ft. and it is carried by a foot step or by a circular track. The connection for raising the step is shown in our illustration with wrench in position, and is on the right hand side in the front view.

In the side view, four levers at the base of the machine are to be seen The one on the left of the picture with the projecting arc controls the friction feed change, the two center ones operate clutches for speed change gears. These are interlocked. The extreme right hand lever, near the center of the base, controls the traverse of the uprights. The operator has all the mechanism for operating the machine within easy reach, and although the tool is a ponderous one it is easily and readily manipulated.



FRONT VIEW OF RIDGEWAY BORING TOOL.

The directors of the Great Western Railroad in England are planning to introduce an American engine on their road, and if it proves to be a success they will use them for the express trains which cover the long distances.

It is the intention of the Lackawanna to have its own fire companies for the protection of its buildings. Four have been organized at the new Keyser Valley shops, and a corps of fire fighters at each coal breaker.

An important improvement contemplated connected with the enterprising Vanderbilt lines is the cutting of a tunnel under the Detroit river for the accommodation of Michigan Central trains.

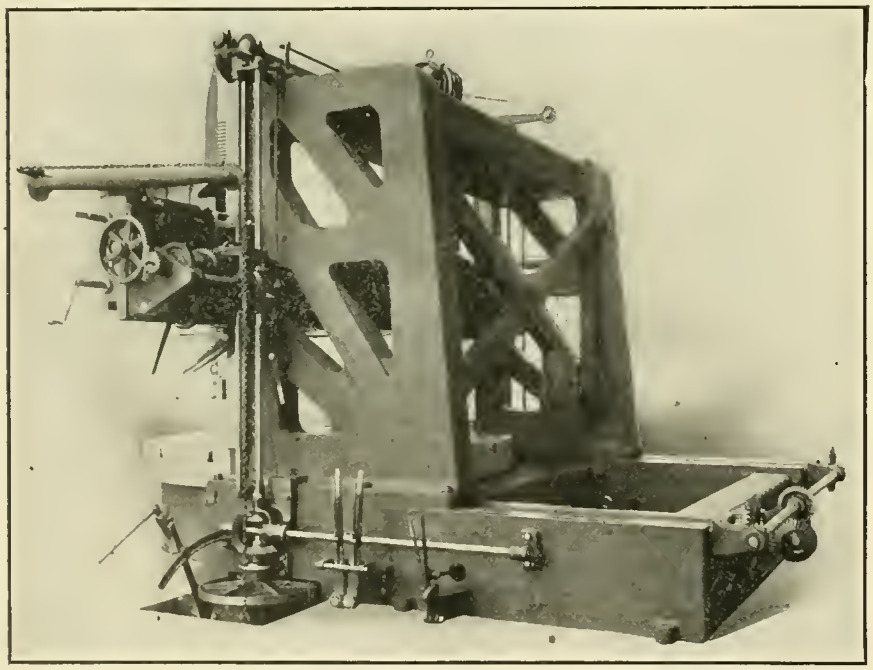
Electricity Direct from Coal and the Law of Evolution.

We have recently read of the work of a Chicago inventor who is said to have generated electricity direct from coal. That is, he has produced a current without the usual intermediates of boiler, steam engine and dynamo. In other words, he has made a sort of electric battery in which coal is one of the elements.

The principle employed is the use of a positive plate of metal and a negative plate of carbon. These two elements are heated to a very high temperature and the compound formed by their union is further reduced by red-hot coal. A current of electricity is given off when the two plates are connected which is said to be sufficiently powerful for industrial uses, and which is destined to supplant the use of steam.

The data before us is not sufficient to form any very satisfactory opinion as to the merits of the invention, but this much is clear: heat in considerable quantity must be applied or the battery will not work. No one denies that such batteries have been made before now, and they have produced an electric current. The question of cost, however, comes in, and the production of heat necessary to cause the battery to act takes money. The first cost of the battery and its maintenance have not been given in the account which we have seen. These things are stern realities which must be reckoned with before the successful laboratory experiment becomes a commercial success.

We have no desire to disparage good and useful inventions which have for their object the production of power in any form adapted to the wants of mankind, but we feel certain that the complete displacement of the stationary steam engine as well as that of the locomotive in favor of electricity will be a gradual process.



SIDE VIEW OF RIDGEWAY BORING TOOL.

There is a story in what is called ancient mythology of how the goddess Minerva sprang fully equipped from the brow of Jove. The fable carries hidden in it the idea of the sudden conception of absolute perfection, and though such an idea might inspire reverential awe among the peoples who believed it to be true, it has no place in the modern world of business or in the domain of science at the present day.

We have, in a thousand ways, been made to recognize the dominance of law of evolution, that process of unfolding and gradual development by which the achievement of to-day becomes but the vantage ground for to-morrow's greater effort. The gradual growth of the locomotive, the development of the air brake and the progress of the art of railway signaling are only a few examples of the manifestation of the law of evolution, which is as true of the works of man as it is true in the animal and vegetable kingdoms.

History has been called the record of past events, and nowhere does that record show that sudden and radical change has come like a bolt out of the blue. Dynamic electricity may in time supersede the steam locomotive as a motive power, and the coal battery may eventually take the place of the steam boiler and the steam engine, but it will not be done suddenly or in a single night. Orderly progress is the rule, and the extravagant claims for the speedy and complete revolutionizing of existing conditions can no more be realized than the dream of the alchemists of old who sought for the philosopher's stone, that they might instantly change all the baser metals to gold.

Boiler Failures — Their Cause and Remedy.

It is gratifying to know that several of our trunk lines by persistent effort and honest investigation have come very near the solution of the vexatious leaky flue problem. Disregarding the most vital principle to the successful operation of a locomotive boiler, circulation, our present type with its graceful outline, so pleasing to the eye, is severely wanting in that particular. We have blindly followed in the footprints of our neighbors with most disastrous results, and we have not thought it advisable to try our pet schemes on one or two locomotives merely, but have ordered them by the hundreds, and no sooner have flue failures made their appearance under these conditions than we begin to saddle the responsibility upon the engine crew. Compare the boiler of former years with the boiler of to-day. We considered it good practice at one time to space our flues 1¼ ins. apart. Now we are down to ⅝ in. in order to obtain that coveted prize, greater flue area and heating surface. What a fallacy! The perfect circulation we formerly obtained has given way to a partial and defective circulation, and in bad water districts, where scale formation is very rapid, there is scarcely any circulation at all.

Nor does our method of washing boilers relieve the situation. With the much despised diamond stack we could force the water lengthwise of the flues; now we place the washout holes at random on the top and sides in the barrel of the boiler to wash the scale down on the lower flues where it collects and remains. The benefit we sought in the extension front end was not only imaginary but added to our grief. There is no denying that this type of front end is very much overrated and one of the several causes of so many flue failures. With this type the hardest draught is exerted on the lower flues and with defective or no circulation these flues are short-lived. When the exhaust exerts a draught on the fire the restricted water space prevents any water remaining on the flues and they become overheated; and when the action on the fire ceases contraction takes place by the return of the water to these flues, and we have leaky flues. It is always the lower flues that leak and it is always the lower flues that are removed when partial removal is found necessary. Deduct their area and you have the actual and effective heating surface.

We have gone to another extreme also, applying very long flues without increasing their gauge or compensating for the higher steam pressure. In a test now in progress on the Burlington system at Brookfield, Mo., it has been found that increasing the thickness and width of the copper ferrule has relieved the situation astonishingly. The ferrules used on the test engine are 3/16 by 1 in. Where formerly it was found necessary to remove the flues after six months' service the engine so changed has already completed thirteen months without any failure and with every indication of two years' successful service.

There is no denying that engine crews can materially reduce flue failures and the blame rests entirely with the superior officer who in the past instructed the engineer that no bad results obtained from injecting water into the boiler while the engine was standing or drifting. We have taught them that the trouble was entirely due to the fact of leaving the fire door open too long. Less damage by far is done by this practice than by the in-judicious use of the injector. The varying temperatures caused by the former is nothing in comparison to that caused by the latter and not one-hundredth part so injurious. This was pointed out many years ago when Sinclair first published his book on Locomotive Engine Running.

We know that with the present boiler check and its faulty delivery of water to the boiler, we produce two distinct and widely varying temperatures in the boiler when the engine is at rest. Since the temperature of the water entering the boiler from the injector is many degrees lower than that of the boiler contents and of greater density, the injected water naturally flows to the bottom of the boiler and remains there until such time as agitation takes place and circulation begins, or as soon thereafter as an artificial draft on the fire has been created. This is amply proved by the gradual fall of the steam gauge pressure when opening the fire door and the sudden fall of the gauge pressure, 10 to 15 lbs., in starting the engine after the boiler has been filled while the engine is at rest. We never obtain such great and sudden changes through the fire door.

No locomotive has any right to be on the main line whose boiler is unable to furnish the necessary steam pressure or does not permit the maintenance of a uniform water level under normal or forced conditions if properly managed by the engine crew. Abnormal conditions distract the mind of the crew from train orders and increase the hazard.

If the design and construction of the boiler are perfect and the capacity to generate steam adequate the cause of too frequent failures is usually found in a faulty front end draft arrangement, a too great tonnage rating, poor coal and a wornout or inexperienced fireman. Overcome these evils, educate the engine crew correctly and there will be no necessity for injecting bran, sawdust, etc., into the boiler to obtain partial relief and to get trains over the line.

TRAVELING ENGINEER.

Bulletin No. 22, issued by the Union Switch & Signal Company, of Swissvale, Pa., has just been issued. It is an illustrated explanation of the operation and maintenance of the Automatic Union Electric Semaphore Signal. There are two very clear half-tones of the mechanism used with each part numbered, so that the description of the machine and the way it works may be easily followed by the reader. The first illustration shows the running gear and shield mechanism of the signal and the second shows the central vertical section of the mechanism and the frame. The "machinery" of these signals is placed in a very confined space and is an example of carefully worked-out design. Anyone interested in seeing how the signals are operated and what it means to produce the results achieved, should apply for a copy.

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

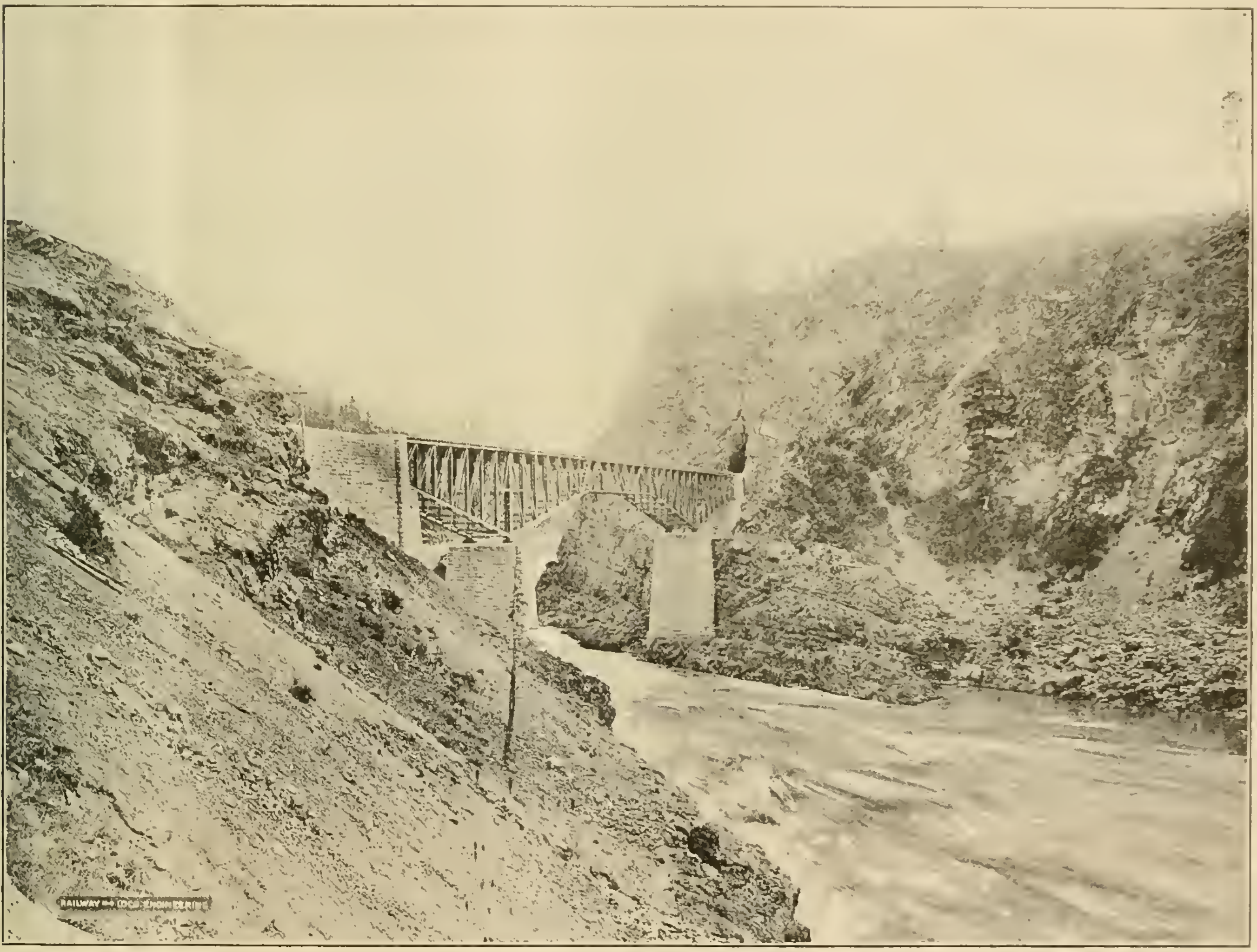
Vol. XVIII. 136 Liberty Street, New York, May, 1905 No. 5

Cantilever Bridges.

Our illustration shows a bridge on the Canadian Pacific which is one of the class known as cantilevers. It crosses the Fraser, which is a typical river of mountainous regions, with its rapid current and high precipitous banks. This form of bridge is peculiarly suitable for carrying a road over such a chasm. The bridge has a long reach from pier to pier, and both of these piers are on land, and are in fact high steel towers, and the abutments are well up on the steep slope at bridge floor level.

The shore section near the observer in our illustration shows the pier as a tower, very like the upright portion of the letter T, while two girders evenly balanced form the cross piece of that letter. This kind of bridge is built without false works beneath it because of the fact that when the pier has been erected the trusses from it can be built out, equally on both sides at the same time and so preserve the balance at all times.

When both these huge T-shaped structures have been built, one on each bank of the river, there remains a short central span which hangs from the ends of the two cantilevers and connects them, but before the short central connecting span can be put in a most important and indeed characteristic piece of work must be done. We say



CANTILEVER BRIDGE OVER THE FRASER RIVER, NEAR CISCO, B. C., ON THE CANADIAN PACIFIC RAILWAY.

characteristic, because in the majority of bridges the weight of the structure is sufficient to hold it down, and there is no danger of any part of the bridge breaking away in an upward direction.

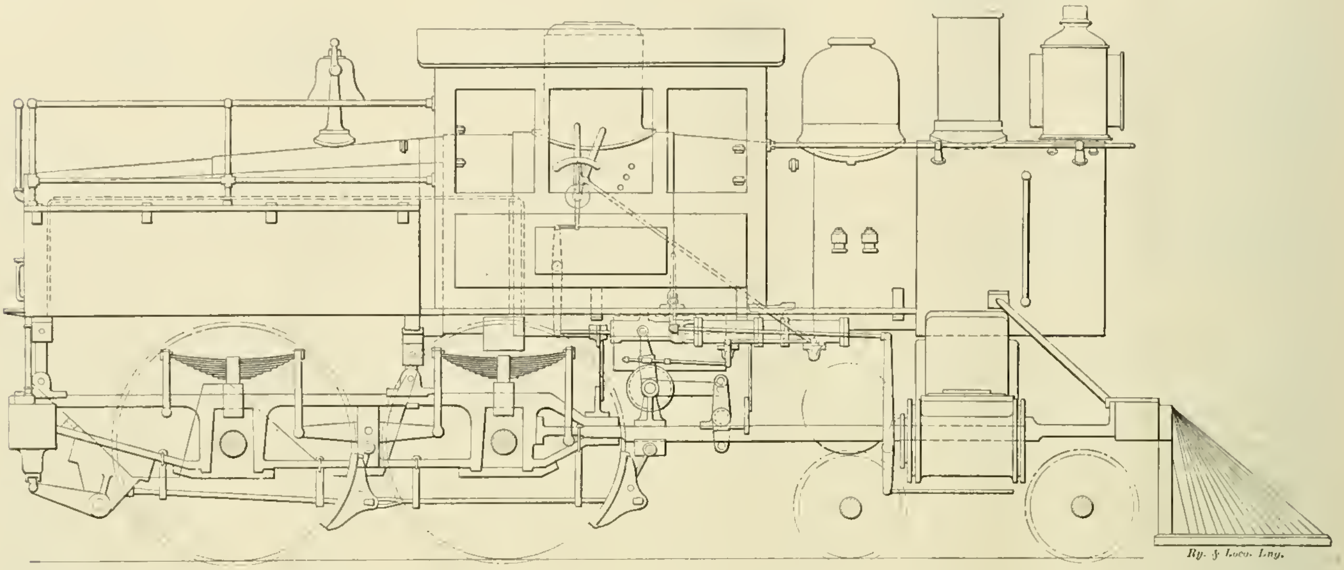
With cantilever bridges it is necessary to securely anchor down the shore ends, otherwise a weight on the river end of either of the large T-shaped cantilevers would cause the shore end of the part affected to be tilted upward and the structure to fall into the river. As soon as the shore ends are securely anchored down the short level connecting span is built out from the river ends of each and joined above the center of the rushing stream.

It has been claimed that this bridge at Cisco, B. C., was the first of its kind to be begun on this continent, though on account of the remote region where it was erected and the time required to get bridge material so far from the point of manufacture, it is probable that the Michigan Central bridge at Niagara Falls, which is one of the same class, was completed first.

Cantilever bridges are now greatly in favor among engineers for far-reaching spans and many of them are in use, the Forth Bridge, in Scotland, being the best known.

Steam Reverse Gear Once on P. & R.

In the days before balanced valves and inside admission piston valves came into vogue, the Philadelphia & Reading put a steam reversing gear on their passenger locomotives. The device was ingenious, and performed its functions well, but was somewhat expensive to keep in good repair. The P. & R. abandoned the use of it some years ago. The design of this reverse gear was briefly that it incorporated a throttle rigging device with the steam reverse gear, and though both these were as separate as they are on an ordinarily designed engine, both levers were placed side by side and were of the same size.

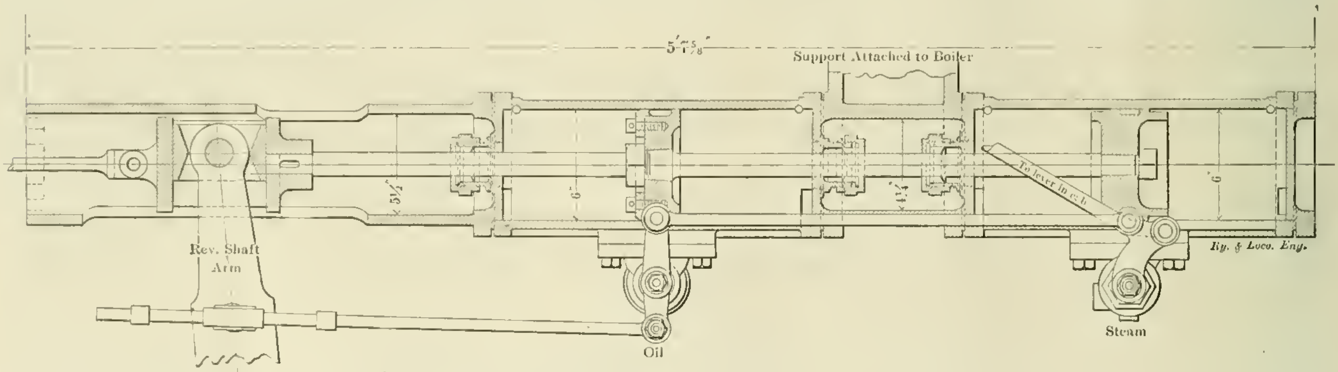


HARD COAL BURNING PASSENGER ENGINE ON THE P. & R., AS FORMERLY FITTED WITH STEAM REVERSE GEAR.

The throttle lever was a small 12 in. one, with latch like a miniature reverse lever, and as it stood in an upright position it looked still more like it. This lever when moved back and forward rotated a horizontal spindle which passed into the boiler through a hollow case, the spindle terminating in a lever below the dome, by which the throttle valve was opened and closed.

The steam reverse lever was of the same size as the throttle lever, and also stood in an upright position. The fulcrum of this lever was the end of the spindle which the throttle lever rotated. The reverse lever had a latch, but only one notch in the center, so that it was impossible to hold it permanently in either the forward or back position. The reason for this was simply that what may be called the reach rod was a small bar of round iron which was attached to a bell crank operating a small steam admission and release valve.

The real reverse mechanism consisted of a pair of cylinders, each 6 x 12 ins., placed in a horizontal position just below the running board. These cylinders were in line with each other, but separated by a spacing casting with glands, like that between the steam and air cylinders of a Westinghouse pump. A long rod connected the tandem pistons of the reversing gear and an extension of the rod operates the reversing arm shaft.



STEAM REVERSING MECHANISM, AS FORMERLY USED ON THE P. & R.

The first or forward cylinder was the steam cylinder, and its piston moved forward or back, as steam was introduced into the forward or back end. The second cylinder was an oil cylinder, kept constantly full, there being underneath it a by-pass valve by which oil passed from one side of the piston to the other. The oil could only pass from one end of the cylinder to the other, and in this respect was similar to the recoil mechanism of a heavy gun. It is easy to see that when the by-pass valve was closed, the cylinder with the imprisoned oil completely filling the space on either side of the piston, formed a lock which securely held the reversing shaft arm in whatever position it had been put. The oil by-pass valve was actuated by the bell crank from the steam cylinder's admission valve, so that when one was open the other had to be open, and when one was shut both were shut.

The oil by-pass valve crank looks like an ordinary rocker arm, and from the lower end a rod runs to and passes through a guide on the reverse shaft arm. This guide is capable of rotating with the motion of the arm. There are two tappets on the rod, and the guide striking one of these just as the reversing arm reaches full throw forward or back, insures the oil by-pass and reversing steam valve being automatically closed when the reverse mechanism has been put "in the corner."

The little reverse lever in the cab has to be brought back to the central position every time the reversing gear has been used, because in order to hold the links in any position the steam and by-pass valves must be closed. The closing of the steam valve exhausted the steam from the cylinder.

In order to show how the links stood, an indicator having a needle point travels along the side of this quadrant and shows where a large reverse lever would be with the links in such and such a position. This indicator is worked by a series of rods and levers leading from the extension piston rod of the reversing gear up to the cab. The indicator showed the engineer, when he tried to "notch up," if the mechanism had actually placed the links where he desired them to be. In this it resembled the indicators which connect engine room and bridge on an ocean going ship. There being no actual notches for the reverse lever, there was no limit to the variation in the length of cut-off which might be had.

The Newton & North Western Railway have recently constructed a modern 4-stall roundhouse, at Boone, Iowa. They also have a small machine shop in connection with the new roundhouse and all light and running repairs are made to their locomotives at Boone.

Watching the Automatic Stoker at Work.

BY ANGUS SINCLAIR.

At the American Railway Master Mechanics' Convention held in June last year a report on automatic stokers, prepared by a committee, was read, which was decidedly favorable to the use of automatic stokers, but it did not indicate that railway companies were by any means enthusiastic in favor of that useful labor-saving device. The apathy which prevailed, however, had not prevented the application of automatic stokers to a sufficient number of locomotives to demonstrate the utility of such an apparatus. The committee investigating the subject among other things said:

"Saving in Fuel.—The only comparative test that your committee has been able to make shows that there is a saving of not less than seven per cent. when using the stoker as compared to the work done by a first-class fireman. This, of course, would indicate a considerably greater saving as compared with locomotive firemen as they are ordinarily found. In the case mentioned, the engine equipped with the stoker

AMERICAN LOCOMOTIVE COMPANY'S TRAIN OF ENGINES FOR THE KIUSHIU RAILWAY OF JAPAN.

was in service over its run six hours and thirty minutes, while the engine that it was compared with was only four hours and seven minutes going over the same length of division.

"The saving in coal when using the stoker is no doubt very largely due to the fact that when using the stoker the coal is much more evenly distributed and the furnace door remains closed all the time.

"Smoke.—When using the stoker the smoke is very much lighter in color, indicating, of course, a much more thorough consumption of the gases. The darkest color, when the stoker is used, is not more than brown, while most of the time the emission from the stack shows pure steam.

"Reducing the Work of the Fireman—When the stoker is used the fireman has to raise the coal from the level of the coal bin of the tender into the hopper of the stoker, a distance of about thirty inches. This is more of a raise than when firing directly into the furnace, but it must be remembered that when the stoker is used the fireman is not required to throw the coal at all. With the coal conveyor in service the labor of raising the coal into the hopper will be entirely dispensed with and the work of the fireman becomes simply that of an expert in charge of an efficient machine.

"Saving in Repairs to Fire Box.—There is no doubt but that with the stoker in use very much less trouble with leaky flues will be found on account of maintaining a more even heat in the fire box. The sheets of the fire box will last longer for the same reason. It has been proved that corrugation in fire boxes is due largely to the changes in the temperature in the fire boxes."

The stoker referred to was the Day-Kincaid, which has been before the public for about three years, but had failed to gain popularity principally because it was not in the hands of people with the ability or means for pushing it into the good graces of railway men. A few months ago an influential company, known as the Victor Stoker Company, was organized to promote the introduction of automatic stokers for locomotives and steamships; and the indications are that the capitalists interested in this company will succeed in a few years in making the automatic stoker as regular an attachment on locomotives as the driver brake or the injector is to-day.

The history of the introduction of improved appliances upon railroad rolling stock informs us that such appliances as injectors, efficient safety valves, air brakes, sight feed lubricators and other devices now considered essential for safety and comfort, were not introduced in the first instance because railroad officials approved of them, but because enterprising makers perceived that the improvements were necessary and by energetic advocacy brought the people in charge of railway rolling stock to that way of thinking. It was a case of supply creating a demand.

The automatic stoker is going to pass through experiences similar to that undergone by most of the devices mentioned. For the last three years railway officials have been invited to patronize the stoker and some of them agreed to give it a trial. But there was no strong influence behind it to demand a fair trial with favorable usage, the kind of benevolent encouragement that brought other novel devices safely out of their swaddling clothes; and so minor defects were magnified into impracticable weaknesses and the apparatus was thrown aside without proper tests or trials.

The Victor Stoker Company are in a position to change all this, and they have inaugurated a policy which is bound to have their automatic stokers judged on their merits. If the stoker permanently fails it will be because it lacks the essential elements of practicability. The company have received permission to equip with the stoker all the passenger engines on the Cincinnati-Indianapolis division of the Big Four System, and they now have seven of them in use, some of them having fed fire boxes with coal during the fiercest weather of the past winter.

During a recent visit to Cincinnati I was invited to ride on an engine equipped with one of these stokers, when it was hauling a passenger train from Cincinnati to Indianapolis, and I was glad to accept the invitation that I might judge for myself the efficiency or otherwise of the stoker. Having fired locomotive fire boxes, marine furnaces and nearly all other kinds of furnaces in my time, I can tell from my own personal observation the success or defects of firing by hand or by machine.

The engine assigned to the train was of the Atlantic type with a wide fire box, illustrated in Railway and Locomotive Engineering of December, 1902, and also shown in the book, "Twentieth Century Locomotives."

As this engine was backing to the train it jumped the track owing to a broken switch rod, and another engine had to be got ready hurriedly to take out the train. The emergency substitute was an ordinary eight-wheeler, known as the Garstang type, an excellent engine for its size, but deficient in power for the train to be hauled, which is known as the White City Special. The engine, No. 191, has cylinders 18½x24 ins., driving wheels 68 ins. diameter, a long fire box set above the frames, giving 28 sq. ft. of grate area, and 138 sq. ft. of heating surface, the boiler providing 1,587.6 sq. ft. surface, a total heating surface of 1,725.6 sq ft.

When this engine was backed to the train the fireman was operating the stoker at is full capacity, getting in a fire heavy enough for starting. The blower was kept hard at work converting the heavy charge of coal into fire. The engineer was hurriedly oiling round, and there was a general air of bustle and excitement, so frequently seen when a locomotive has to be prepared hurriedly to take out an important train. When the signal to start was given, however, both engineer and fireman settled down calmly to their work and the engine performed as well as if full time had been spent in getting it ready. The steam pressure carried was 180 lbs., and the gauge pointer seldom dropped below that figure. The fireman seemed strange to the stoker, and as far as I could make out, experimented to see in what way it would work most efficiently. At such times the steam would fall ten or twenty pounds, but on some other change being made the steam would rise very quickly. All the fireman did was to keep the hopper of the stoker charged with coal and regulate the feeding mechanism, which appeared to be easily done. With the exception of a few unimportant fluctuations the boiler steamed perfectly while doing very hard work.

The fireman, of course, kept watching the fire and regulated the fuel feeding mechanism to maintain what he considered the proper depth of fire and to keep the fuel evenly over the grates.

The train consisted of five heavy cars, one of them a parlor and one sleeper. The distance from Cincinnati to Indianapolis is 111 miles and the schedule time is two hours and forty-five minutes, including the time taken to make three stops. That makes the average running time about 45 miles an hour, but on the day this run was made the train started 17 minutes late, which was all made up, raising the runnning time to about 50 miles an hour, which called for very effective work from an 18½x24 in. engine.

Since observing the performance of the stoker on that run I have learned that one of the 4-4-2 engines equipped with the stoker had, in the month of March, run 7,325 miles in passenger train service with but one removal of the stoker, which was done owing to a faulty lubricator.

The men in charge of the mechanical department are doing their cordial best to give the stoker a fair trial. Many devices applied to locomotives have failed for want of proper attention from the men attending to effecting repairs. A machinist with no knowledge of the device would be sent to repair an air pump or injector that was not working properly and he would fail to locate and remedy the source of trouble; on that account there was much unnecessary harassment experienced with these devices in the early periods of their introduction and they never gave entire satisfaction until men who were experts on the mechanism were put in charge.

The men promoting the Victor Stoker are not going to have their device condemned for want of proper care in handling and in maintenance. They have had one of the brightest firemen on the road assigned the duty of instructing others on the handling of the apparatus on the engine; and they have obtained the services of one of the most intelligent and skilful machinists in the shops to attend to the repairs.

Several changes have been made on the stoker since it was first brought out, and other improvements will, no doubt, be suggested by experience with the apparatus. It consists essentially of an oblong iron hopper for holding the coal and a plunger for projecting the fuel into the fire box. The hopper is provided with a revolving worm for carrying the fuel forward which seems to be a superfluity as the vibration of the engine does all the carrying needed. In the first stokers used the steam cylinder used for actuating the plunger was located beneath the hopper, but in those of recent make it is set vertically near the boiler head, when it is away from the dirt that lands on the footplate.

A proposal which does not strike me favorably has been made to provide a special fire door beneath the ordinary door, and another suggestion is to enlarge the existing door so that fire cleaning irons can be used without removing the stoker. When the stoker is operated skilfully an even fairly light fire is carried which does not call for much cleaning. It is very common to make the round trip from Cincinnati to Indianapolis and back without cleaning the fire, and they have a record of one engine running over 900 miles hauling heavy passenger trains without the fire being cleaned. Of course, they burn exceptionally good coal on that part of the Big Four System.

We receive clippings from a concern that makes a specialty of supplying items of published news. What we call for is news relating to railway machinery, but the line is not very closely drawn. When news is scarce, items relating to railroad accidents are sent us, and curiously enough nearly all the accidents described have happened on the New York, New Haven & Hartford system. We do not suppose that the this road has more accidents than its neighbors, but the newsgatherers take delight in telling about its accidents.

Railroading in South Africa.

BY GEORGE E. WALSH.

The development of South Africa since the Boer war has been chiefly along the lines of the railroads, and railroad building has been coextensive with the development and colonization of the most fertile parts of the country. To a certain extent there has been an intense rivalry between France, Germany, England and other European colonizing powers in constructing railroad lines in their respective territories in Africa. Realizing the vast riches and resources of the country, and conscious of the fact that these could only be developed and utilized by building railroads, the different powers have been engaged in an international railroad building race in the Black Continent that has completely transformed the face of the land. From 9,000 miles of railroad to nearly 15,000 within five years is a high record in a pioneer, uncivilized, and half-explored country that stands almost alone in history.

Africa is pre-eminently the land of the strange and unexpected. Its jungles are filled with the greatest array of wild, savage animals; its forests and plains peopled with black races which have been almost continually at war among themselves or with the pioneer whites in the past; its streams and great inland seas have yielded swarms of strange fish and amphibious animals; while its deserts, woods and swamps have teemed with multitudes of flies and insects that made life miserable to man and beast.

The tsetse fly has rendered horseflesh an expensive luxury, and practically limited the value of this beast for transportation purposes. Several times stage lines were established in populous parts of South Africa to accommodate the traffic, but the horses were killed off by the tsetse flies until the whole enterprise had to be abandoned. Mules and other beasts of burden were tried with similar results. The only horse, camel or mule that proved absolutely immune to the bite of tsetse fly was the locomotive, and as far as heard from, the automobile enjoys similar immunity from this terrible flea bite.

So the steam locomotive is rapidly making its way throughout the heart of Africa, penetrating the inland districts, connecting the gold and diamond mines with Cape Town, and crossing the great tropical belt of middle Africa, and even following the footsteps of Stanley and Dr. Livingstone in the lake region. It will only be a few decades before excursions to Stanley's "Heart of Africa" will be running, and popular "one-fare" trips to Dr. Livingstone's tomb. The diamond fields of South Africa, no less than its gold regions, will attract the inquisitive excursionists, and special trains will wind up the Zambesi or cross the edge of the great desert of Sahara.

DESTROYED BRIDGE OVER THE COLENSO RIVER, AND TEMPORARY RAILWAY TRESTLE AND FOOT BRIDGE, SOUTH AFRICA.

Railroad building in Africa has the unique distinction of affording direct comparisons between the work of different nations. The French and German engineers often toil away on roads that close together at some neutral point, while English and American railroad builders survey parallel lines intended to open up heretofore inaccessible regions. The English have by far the greatest number of miles of railroads in Africa, either completed or projected, and as American engineers have made their influences felt in English railroad circles, it may be said that American roads have found their way into Africa. The French colonies have nearly a thousand miles of new railroads in their territories, and as many more in the course of construction, while the English colonies boast of some 1,800 miles of new roads and about 400 miles projected. The German colonies are still behind the Portuguese in the extent of their railroad lines, while the Anglo-Egyptian-Sudan roads number nearly 800 miles completed or in the course of construction.

One of the chief features of railroad building in Africa to-day is that the work is carried on mostly in the wilds of the unsettled regions, and not in the northern settled lands of Tunis, Egypt, Algeria or in Cape Colony and Natal. The railroad builders have begun the stupendous task of opening up tropical and central Africa, which for a century has defied the efforts of explorers and colonizers.

There is no more interesting problem offered to-day for pioneer railroad engineers than the opening up of the Dark Continent. The tropical belt is the most unhealthy and difficult region of the world for workmen to toil in. Besides flies and insects whose bite is either fatal or threatening to the welfare of man or beast, the savage tribes and numerous wild animals contest nearly every mile of road that is pushed into the interior. Tropical rains of an extraordinary character interfere with the workmen and desert sandstorms sweep up at most inopportune moments to overwhelm the laborers.

Fortunately, white men can organize and direct the railroad work, and native blacks can frequently be depended upon to do the hard work. Without the latter the Beira Railroad or the Uganda road could never have been constructed. Both of these pass through dangerous climates and encountered great natural obstacles. The Beira-Minini Railroad is 220 miles long and passes through a hot, miasmatic climate which made work on it almost beyond comparison. Many a brave engineer and workman laid down his life for its existence, and to-day trains run through a region which formerly none except the hardy explorer and miner passed. By means of this road the gold fields of the interior are directly connected with the port of Beira, and the land is being rapidly developed on all sides.

TEMPORARY TRESTLE, AND DESTROYED MAIN LINE BRIDGE, KAAPMINDEN, SOUTH AFRICA.

The famous slogan of "The Cape to Cairo Railroad" is rapidly being brought to a definite point, and railroad builders expect to see this dream realized within the present decade. Then the terrors of interior tropical Africa will be conquered, and excursionists may travel over regions made famous by Livingstone, Stanley and DuChallau. Already trains run from Cape Town to the great falls of the Zambesi. This is 1,644 miles north of Cape Town. This wonderful region, rich in the beauty of landscape and natural products, and valuable from an historical point, has already become a sort of central meeting point between the north and south of Africa. By availing themselves of the steamboats which traverse the Nile, passengers can pass straight through the Dark Continent lengthwise.

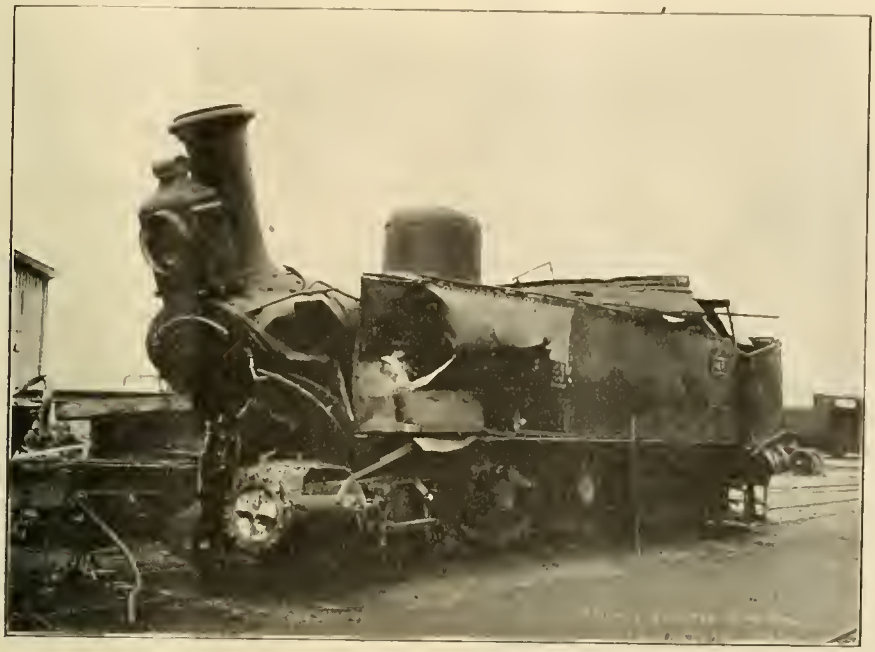
Famous Timbuctu, which two decades ago was never visited by white men, and which was as hostile to strangers as Thibet is to-day, has been robbed of its terrors by the railroad builders, who now carry the soldiers and products of France directly to the natives by rail and steamboat. Under French military protection, excursionists can to-day go up the Senegal river as far as Kayes, and then take the railroad to Bamako on the Niger, traversing altogether some 345 miles by rail.

The Mombasa-Victoria Nyanza road is some 584 miles in length, and it passes through the most picturesque country in the world, enabling passengers to pass directly from the Indian ocean to the famous Victoria Nyanza falls. It is hardly conceivable that within the present generation, or, rather, decade, the Dark Continent has been so generally tamed and civilized by the railroad. The steam whistle is heard to-day almost daily where a score of years ago imaginative stories peopled the land with strange dwarfs, fierce African tribes, strange wild beasts and insects and diseases which killed off nearly every exploration party that ventured inland. Even the Sahara desert is not held sacred by the modern railroad builders. The edge of the desert has been cut off by at least one line, and others are projected to cross it in several places. Within another decade the usefulness of the camel will be largely restricted. The steam roads will carry the freight and passengers across the desert which heretofore have depended entirely upon the camels for transportation.

The cost of transportation of freight in Africa before the roads were constructed was almost prohibitive, and no actual development of even the gold mines could be made far from the interior. The common cost of freight transportation in those days amounted to about $100 per ton for each hundred miles. To-day the cost of transportation over the same routes runs from $15 to $20 per ton for each hundred miles, a high rate, it is true, but so much less compared with former cost that miners and tillers of the soil look upon it as a godsend. The loss in transportation is so much less also that this difference is further emphasized. Formerly transportation parties were attacked by savages, wild animals or disease so that half or all their valuables were frequently abandoned somewhere on the route. Mining machinery left for any length of time in the forests or along the low, sluggish water-courses would soon rust and decay past recovery.

As many of the railroads in interior Africa are of the narrow gauge type.

travel is naturally slow and somewhat primitive, but the passengers traveling through the region for the first time never count this as a serious drawback. There is too much to see to make a quick transit of the continent desirable.



ACCIDENT TO ENGINE OF CAPE MAIL TRAIN, SOUTH AFRICA. CAR OF RAILS RAN DOWN GRADE AND COLLIDED WITH TRAIN.

The scenery is beyond compare—primitive, picturesque, gigantic and unique. From the car windows, crouching lions, huge crocodiles basking in the sun and wild elephants and hippopotamuses may occasionally be seen in their natural environments. Under such circumstances who would care for rapid transit?

It is generally predicted by railroad experts that Africa within a few years will have at least 25,000 miles of railroad, and the whole country will rapidly develop under the hand of the white pioneers. Roads are being mapped out in all directions, and there is scarcely an important part of the land that has not attracted the eye of shrewd engineers and capitalists. While many of these roads on paper may never be built, or if started they may be later abandoned, it is quite certain that others will spring up to take their place.

The struggle for supremacy in railroad building in Africa will never repeat the costly experiments made in developing this country by constructing needless parallel lines. The great size of the country, and its vast resources, make it imperative that every road built should be profitable by controlling the traffic of an exclusive territory. The engineers in constructing the bridges, tunnels and other important equipments of the new roads are availing themselves of the best machinery known in the world. To a certain extent Africa presents the spectacle of international bridge and railroad building, with the engineers utilizing the products and inventions of every country. The iron and steel bridges of American design and construction are quite noteworthy and their appearance in that out-of-the-way corner of the world is practical testimony to our skill and ingenuity in this direction. A number of American engines and cars are likewise running regularly on the African roads. American engineers and railroad constructors are among the working gangs of nearly every pioneer company in Africa, whether it is the German, French, Italian, Portuguese or English colonies. Without actually possessing any colonies in Africa, American genius and skill are quietly impressing upon the country the progress of the Western Continent.

How Are the Mighty Fallen!

As a ballast train on the C. P. R. was working at Vancouver, B. C., it was suddenly left minus its locomotive. The engine had pulled a train of loaded flat cars on to an embankment near the city and was standing there quietly supplying steam to the busy ballast unloader, which was one of the Lidgerwood type, when all at once the ground gave way under the locomotive, and as if volunteering to assist in filling in the hole, the big engine plunged down about ten feet.

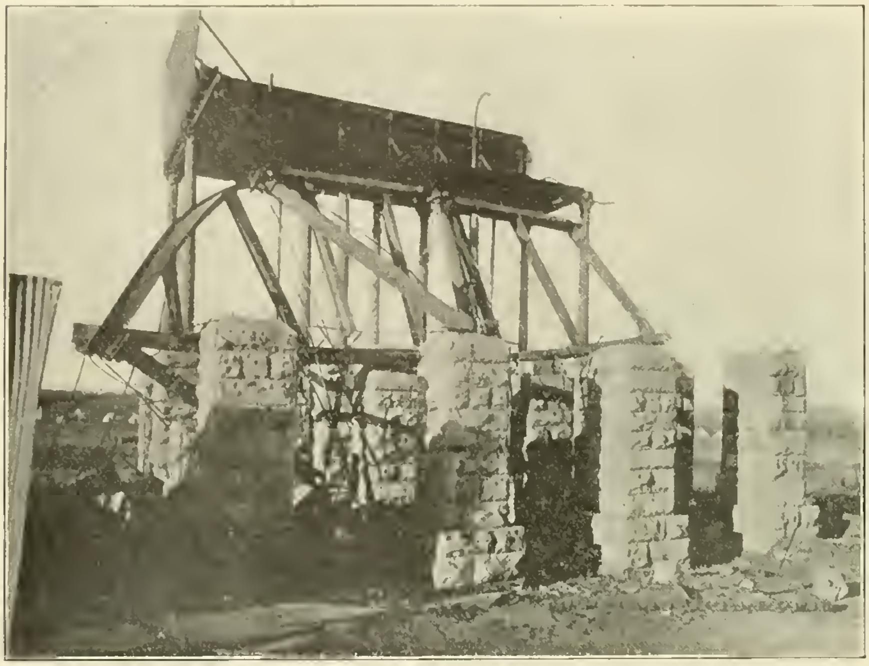
Fortunately no one was hurt, as the engineer and fireman jumped when they felt the temporary track begin to give. The tender followed, but neither the ballast unloader nor any of the cars were moved, as one of the couplers at the front "let go" in time. The ballast unloader, when supplied with steam from another engine, gallantly attempted to pull the fallen monster out of the hole, but without avail. It, however, broke its cable and damaged one of its pulley blocks as an evidence of good faith, after which the prosaic wrecking gang were called in and put things to rights.

Lassoed In His Engine Cab.

Attempting to lasso a locomotive, a Downingtown (Pa.) boy nearly caused the death of a fireman on the engine. The lad was in charge of a switch on a bridge 130 feet above ground, which

INCIDENT IN SOUTH AFRICAN WAR. RAIL REMOVED FROM TRACK.

is being built for the low-grade freight line. He had been practicing with the rope and thought it would be sport to catch some projection of the locomotive. He fastened one end of the rope to a beam, and as the engine passed cast the loop at it. Just then the fireman leaned from the cab and the noose settled about his shoulders, so that he was drawn out until only his legs remained, when the rope broke and released him.



RAILROAD TANK. DAMAGED AS AN ACT OF WAR.

Grades on the Grand Trunk Pacific.

The G. T. P., being the latest transcontinental project, one would expect it to be a great improvement in the matter of grades over any previously built line. The heaviest grade on the Canadian Pacific is that through the Kicking Horse Pass; it is 4½ per cent., or in other words the rise is about 250 ft. per mile. The usual grade through the mountains is 2 per cent., or about 103 ft. to the mile. The maximum grade on the G. T. P. in the mountain district will be 1½ per cent., or about 78 ft. per mile.

Railways as Temperance Workers.

At the end of the last fiscal year the British government, although showing a surplus in the treasury, found on analyzing the items of revenue that the receipts from the tax on beer and spirits were very much less than in any of the preceding fifteen years. Mr. Austin Chamberlain, chancellor of the exchequer, in commenting on the fact in Parliament said, "the habits of the people are changing, and this must be taken into account in considering the financial situation. The majority of the people are finding other employment for the money they used to spend in public houses. Outdoor recreation and excursions are becoming more popular."

It is not to be doubted that this change has largely, if not entirely, been brought about by the railway companies providing not only cheap, but attractive excursions, and that these have been extensively patronized.

Hydraulic Train Stop.

The Caledonian Railway of Scotland have in one of their terminal stations a pair of hydraulic buffers which are intended to act as stop blocks at the "end of track." The buffers are on the end of long piston rods, which pass into cylinders which are securely bolted to heavy timber beds. The pistons have a travel of seven feet.

The whole apparatus is designed on the same principle as the recoil mechanism of a gun. The cylinders are filled full of oil and as the pistons are forced from the back to the front of the cylinders in the act of stopping a train, the oil flows out through a by-pass valve from in front of the advancing pistons and flows in behind them. A train of 400 tons when moving 10 miles per hour was stopped by these hydraulic train buffers.

Russian Women as Railroad Employees.

The number of women working on Russian railways is gradually increasing. According to the latest returns there are now employed on the twenty-five Russian state railways about 22,000 women as gatekeepers, clerks, telegraph operators, etc. The average wage varies from 130 to 135 rubles yearly, \$65 to \$70. The women clerks receive on an average from 450 rubles to 460 rubles, or about \$230 per year, while the women attendants at stations are paid only 40 rubles, or about \$19.50 a year in addition to free lodging and a few extras.

Producer Gas.

We often see the word Producer Gas used in connection with heating and furnace work. The gas is generated by passing a mixture of air and steam through a glowing bed of fuel in a closed chamber which is called a producer. The fixed gases of the fuel are drawn off with the air and steam. When used for furnace work the hot gas is conducted directly to where it is burned, but when it is desired to use it in gas engines or pass it through burners, the gas has to be cooled and, if one may so say, it must be cleaned. Producer gas is high in calorific value, there being about 140 British Thermal Units in every cubic foot.

VAAL RIVER BRIDGE. CENTER SPAN THROWN DOWN DURING THE BOER WAR.

General Correspondence.

The Care of the Boiler.

Editor:

The life of the locomotive boiler depends largely on the methods practiced by the enginemen; when these men work together and make studied effort to give the very best effort that conditions will permit, the life of the boiler can be extended.

When time saved in freight transit, use of motive power and expense are considered, the prolonging of the life of the boiler is a matter of the greatest importance in locomotive management.

In my article on the use of both injectors, April number, I desired to convey the idea that both injectors should be kept in service, not only for the good of the boiler, but as a matter of convenience. When the injector is out of commission on the engineer's side of the locomotive and the fireman should have occasion to be away for a time, it requires effort on the part of the engineer to get out of a comfortable position on his seat box to go across the cab to work the opposite injector, and unless the engineer is continually trying to give good service, it's "dollars to doughnuts" that steam is wasted through pop valves and water level allowed to go lower than it should.

The enginemen who do not consider it an effort to try to keep steam from wasting via the pop valves, and consider it one of the most important parts of their duties to keep the water level where it should be kept, and a close, constant watch of their fire, are the men who are prolonging the life of the boiler.

In switching service around yards, or at the various stations along the line, or when waiting on sidings, if united effort is the rule instead of the exception, good results are bound to be obtained.

Where the engineer and fireman are both making it an important part of their business to prevent low water, and a low fire at one and the same time these men have their engine in condition to leave a station on short notice, whereas the crew that is negligent in these matters not only work damage to the life of the boiler but fail to make a good showing in the time consumed in getting over the road.

The enginemen who neglect this important part of their duties must wait before pulling out to get their steam and water, or if they leave on short notice the fire must be built up at a time when engine is laboring hard, and at a time when the highest fire box temperature is needed; adding to this condition the fact that water is down and must be replaced before fire box conditions are right and you have one of the causes for poor boiler service; good boiler conditions cannot be maintained where it is the rule instead of the exception to neglect fire and water while doing station duty.

Where engines are not steaming freely, and water must be traded for steam, and water in consequence gets down while pulling train between stations, it becomes necessary, should the station stop be one for water, or orders, to use both injectors, in a case of this kind it is a time saver and a convenience to have both injectors in commission.

In riding on engines with various engine crews I have found a decided amount of lack of knowledge as to the manner of handling their engines when steaming badly, and it becomes a necessity to allow water level to go lower than it should; these crews after shutting off steam put on one or both injectors, and unless steam accumulated rapidly, the blower would be brought into service, but whether blower was used or not it seemed to be the practice with these crews to neglect proper attention to their fire box conditions, if engine pops lifted blower would be shut off, and with some crews dampers would be dropped and fire box door opened a little, although one or possibly both injectors were working full capacity.

My experience has been that a great many of our younger enginemen are not alive to the necessities of such occasions; I am thoroughly convinced that work of the kind described is another one of the causes. Enginemen should not, where stops are short and injectors are working full, allow their blower to be closed, but on the other hand should endeavor to keep up the highest fire box temperature possible regardless of the amount of steam escaping at the pops, for just as sure as they neglect to do this just so sure will they be trading water for steam again before they get out of sight of the station; during this station stop, if it is for water, or if you have plenty of water in the tank, I have found it good practice, particularly in cold weather, to divert steam to tank through one of the injectors, should one of them be idle, when poping could not otherwise be prevented. The condition in which enginemen leave their engines on coal dock tracks at terminals cuts considerable figure in the life of a boiler. I think it the duty of the engineer to see that his boiler is full of water before he leaves engine, all that can possibly be put in and allow the moving of the engine, particular attention should be given to the condition of the fire during this filling-up process, and effort made to have fire box conditions right to hold fire and yet prevent poping until such time as the hostler can attend to the engine. I have on many an occasion seen the injector working, blower in service and the fire being knocked out all at the same time. No railroad company need expect long boiler service where the evils mentioned are continually in evidence; more education is needed along these lines; carelessness and indifference will not make records for the enginemen who neglect important duties.

J. W. Reading.

Grand Rapids, Mich.

Modern Passenger Locomotives.

Editor:

The failures of modern locomotives to fulfill expectations seems to be pretty general. There appears to be little inquiry into the cause, however, in so far as one can learn in current mechanical literature, but there surely must be some reason for it, and the writer believes it to be due to the inefficiency of steam of extremely high pressure at short cut off. An engine carrying 220 pounds steam pressure having 20x24-inch cylinders and a 6-foot wheel represents a certain amount of power; that is, starting power. It does not follow that this engine, taking its starting power as a basis of calculation, will develop speed in a ratio parallel to that of an engine carrying but 140 pounds of steam, and it is its failure to do so that has caused disappointment. Not only that, but the amount of water and fuel necessary to make time with a comparatively slight increase of tonnage has occasioned much surprise among engineers running engines carrying extremely high pressure.

It is the nature of steam that the more rarified the more sensitive it is to the cooling influence of the cylinders. This influence has little or no effect upon the starting power, when the steam supply to cylinders is backed up by direct pressure from boiler, but at short cut off the expansive energy of the steam is not so effective in proportion at 220 pounds as at 140 pounds or less. The writer does not claim 140 pounds to be that at which the expansive energy of steam is most effective. It may be, and is most likely to be, some lower pressure.

The reason is simply a matter of density, or heat carrying power. Steam at extremely high pressure is what is usually known as "good dry steam" by engineers, and to say that "good dry steam" must necessarily be wastefully used, is a bold statement, it being contrary to the general belief on that subject; but we have practical evidence of the fact at hand. The writer does not wish to be understood as favoring "wet" steam" must necessarily be wastefully density necessary to retain a fair degree of heat, so that when the cut off takes place the expansive energy of the confined steam will represent a reasonable proportion of power which is not the case where very high pressures are used.

The writer has had some experience in conducting steam from a boiler to a distance of 200 feet, where it was used in a process of manufacture in which a dangerous explosive was handled, making it necessary to have the boiler some distance from it. Steam at 100 pounds pressure was conducted through 1½-inch pipe, properly lagged. We found that the temperature of the steam at the end of 200 feet of pipe was not high enough. We superheated it after leaving the boiler and found the temperature at end of pipe considerably less than before.

We all know that air discharged from an air pump hot enough to make the discharge pipe a "cherry red" will not heat the main drum, which is but a short distance from the pump. Air lacks the heat carrying quality of steam, and readily imparts what heat it does carry to the absorbing influence of any cold surfaces with which it comes in contact. Highly rarified steam will do the same, though in lesser degree, when it comes in contact with the comparatively cool surfaces of the cylinders. This wasteful use of steam at high pressure is proving a serious handicap to the simple engine, and is furnishing good evidence that we have arrived at a period in the development of the locomotive when we must pocket our prejudices and adopt the compound principle, which, in spite of its failings is destined by sheer force of necessity to be the locomotive of the future for fast passenger service.

T. P. WHELAN.

Engine Struck by Lightning.

Editor:

Regarding the question often asked. Is an engine liable to be struck by lightning? I may say that I know of a case, where one was struck. Engine No. 15 of the Eddy type, was struck by lightning on the Chalton grade, on the Boston & Albany Railroad while pulling passenger. Hub Osgood was the engineer and he was stunned by the shock and fell from his seat to the footplate. His fireman, James Flaherty, got part of the shock, but was able to run the engine to the next station, where help was obtained.

ROBERT G. PATTISON.

Merrick, Mass.

A Suggestion to the Locomotive Builder.

Editor:

I have no doubt Mr. Builder is now well loaded for battle if he should happen to meet Mr. Kellog, of Bakersfield, Cal., who made so many pointed remarks concerning the constructing of a locomotive.

I would like to suggest another improvement which I consider is a very important feature if it could be done. That is to build all heavy locomotives with the piston extension rod the same size as the piston rod and place a gland and packing on the front cylinder cover for it, the same as the piston rod has. I believe this would do away with one very objectionable feature which generally develops some months before the engine is ready for the back shop, namely, the flattening of the driving tires, which not only causes the engine to ride so rough that a man dreads the thought of having to put in three or four months more on the road with her until she goes in for general repairs. When the engine gets into this shape it is almost impossible to keep her pipe joints tight, and this often causes delays on the road and, what's more, the engine is hard on bridges.

If you think this would not help to a great extent and prevent the flattening of the tire, just take an engine that carries 200 lbs. steam pressure and working hard on a hill and figure up the difference in the push on front of both pistons and also on the back. There is the area of the piston rods to be deducted in one case and not in the other, and this makes quite a difference.

J. CALLIN.

Revelstoke, B. C.

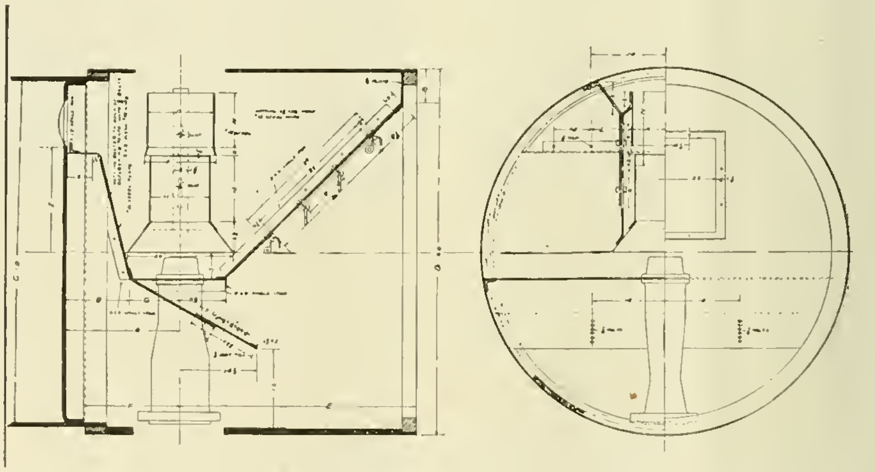
Observations on the Locomotive Front-End.

Editor:

The "front-end" includes the diaphragm, the exhaust nozzle, the exhaust stand, the stack, the petticoat pipe and the netting. These, with the exhaust jet, constitute an apparatus designed to produce the maximum amount of draft through the fire with the minimum of back pressure in the cylinders. The efficiency of the front-end is, therefore, the greatest possible ratio of draft to back pressure.

Considering, first, the diaphragm: The total draft is said to have three approximately equal factors of resistance to overcome—the diaphragm and netting; the flues; and the fire, grates and ash pan. As the diaphragm (or baffle plate) absorbs about one-third of the energy of the exhaust jet, the net efficiency of the front-end is evidently increased as the angle of the diaphragm is changed from the usual angle of 20 degrees toward a more horizontal position, or to an angle of probably 30 degrees. Within certain limitations, the front-end is also increased in efficiency by enlarging the area of opening under the diaphragm damper. Indeed, it is said that there are foreign railroads that have in some manner successfully dispensed with the diaphragm and yet secured equalization of draft over the entire fire box.

The opening under the diaphragm damper must, however, be of such width horizontally as will allow of an area of opening equal to the total cross-sectional area of the opening in the flues, and that must be performed by the exhaust

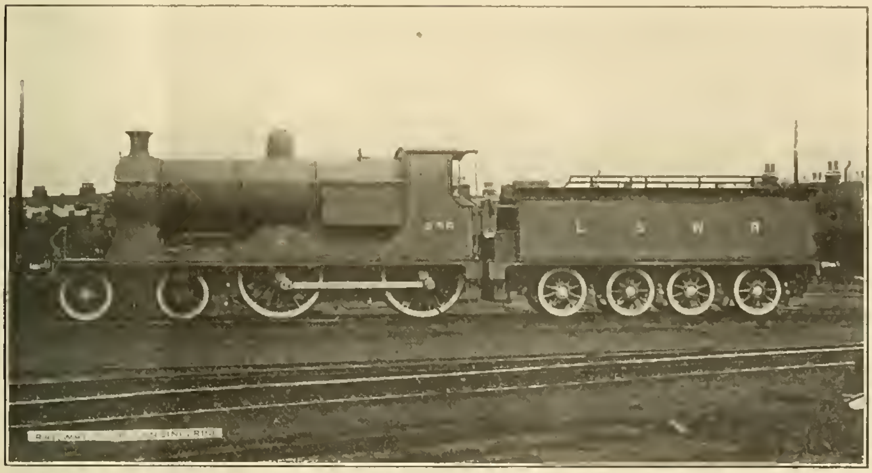


MASTER MECHANICS' ASSOCIATION FRONT-END.

jet, the nozzle may be enlarged or a greater per cent. of its effective energy may be utilized in producing draft through the fire.

Draft through the fire in the back end of the fire box is increased by decreasing the angle of the diaphragm, or by raising the diaphragm damper, also by about six horizontal rows of holes punched in the upper end of the top section of the diaphragm. As the amount of draft is proportional to the weight of steam exhausted per unit of time, it is believed that differences in grate area do not materially change the volume of gases passing under the diaphragm. Contracted opening under the diaphragm or through the grates probably results in slight cylinder back pressure. When the area of opening under the diaphragm is enlarged by raising the diaphragm damper beyond a certain limit, the angle of the diaphragm must be decreased. The effect of wings projecting give the following: Most rapid rate of combustion, slightly stronger draft at the back than at the front end of the fire box, sufficiently baffle the flow of gases as to result in the most complete combustion that the affecting conditions will allow, with minimum resistance to the exhaust jet.

Such a diaphragm should have an angle of about 30, instead of 20 degrees. Just below the arc of a 5-in. radius bend, in the top end of the upper section should be punched about 6 or 8 horizontal rows of ⅜-in. holes with ⅜-in. centers, extending across the upper section a distance equal to the distance between the steam pipe centers at that height. An adjustable damper should be applied, to regulate the area of opening through the holes, in order that the proper degree of draft may be obtained in the back end of the fire box. On the back side of both sections of the diaphragm should be bolted spark



A NEAT ENGLISH 4-4-0.

at the same time be sufficiently contracted as to retard the flow of gases from the fire box long enough to consume as great a per cent. of the gases as conditions will permit. It must also be sufficiently contracted, in self-cleaning front-ends, to obtain enough velocity to keep the front clean of sparks. The diaphragm damper, or movable deflecting plate, must be set at such height as, with a given angle of diaphragm, will produce a slightly stronger draft at the back than at the front end of the fire box. The area of opening under the diaphragm should be greater for slow-burning than for free-burning coal, as, by diminishing the non-effective work at each end of and below the diaphragm is to decrease the draft at the side sheets and to concentrate it along the center of the fire box. The length of the horizontal part of the diaphragm (the distance between the upper and lower sections) does not affect the draft in either end of the fire box.

The most efficient diaphragm should breakers, made of perforated steel plate with 3/16 x 1½ in. mesh, set with slots vertical.

The object in increasing the angle of the diaphragm from 20 degrees (the usual angle) to 30 degrees, is to diminish the resistance to the exhaust jet. But, with such a change in angle, the 8 rows of ⅜-in. holes in the upper section are necessary in order to increase the draft in the back end of the fire box as much as the change of angle increased it in the front end of the fire box. The perforated steel plate bolted to the back side of the diaphragm materially assists in breaking up the cinders as they strike it at an angle, thus considerably increasing their facility in passing through the netting. This is equivalent to increasing the netting area or enlarging the opening of the mesh, and, therefore, lessens the total amount of work that must be performed by the exhaust jet. The horizontal plate of the diaphragm should always, regardless of the height of the exhaust stand, for self-cleaning front ends, be located not to exceed 6 ins. under the top of the exhaust nozzle. In order to get in sufficient netting for free steaming, this plate should never be set higher than 2 ins. below the center line of the smoke box, nor more than 6 ins. below the top of the nozzle.

K. P. Alexander,
Master Mechanic, Ft. S. & W. Rd.
Ft. Smith, Ark.

The Investigating Small Boy.

Editor:

The balmy breezes of early summer had come, and as everything in the shop was running smoothly, and as we were not particularly rushed on work, I had made up my mind to get a few days off and go on a fishing trip to ease my mind up after a hard winter's work. When I broached the subject that night to my wife, she was delighted to hear of it, as her nephew Willie was coming on a visit to us from the city, and as I was especially fond of the boy and had not seen him for some years, it did my heart good to think of the fine time we would have together, for he was just the age to be good fun, loving and observant.

I will admit that my domestic education on boys was somewhat under a cloud, as we had only girls at our house, but my wife assured me that Willie was a boy of a mechanical turn of mind and had an investigating nature, so I looked forward to his arrival with a great deal of pleasure. He finally arrived and about the first evidence he gave of his investigations in mechanics was by overturning an incubator, causing ruination of a hundred eggs my wife had, being hatched in it.

As Willie wanted to look through the shop I decided to take him with me to spend the day there, as I was quite proud of some improved methods of doing work. It would also give me the opportunity of showing him what kind of stuff his Uncle T. was made of.

I was careful to coop Willie up in my office until I had time to take him around, as I had some doubts about his investigating nature. When I got back he had done nothing worse than to screw my revolving chair down so tight that it took four of us to get it loose again, but as he took care to get it out of sight I did not discover this at the time.

Our first stopping place was at the big forging machine, and as they were upsetting heavy rods with an exceptionally long upset. Fig. 1, a description of the dies and header, Figs. 2 and 3, may be given. The enormous power exerted by this machine impressed Willie, and I had to explain as best I could the working parts, for his questions came thick and fast.

Our big punch and shear was the next stop, and as we were punching I-beams on one side, used for truck bolsters, the methods employed for accurate and rapid work is shown the punch in Fig. 4, Fig. 5, the die and tables, and Figs. 6, 7, and 8 the truck for handling them. The other side of the machine was punching steel body bolsters and as we had broken a couple of pendulum heads, I had to have a specially constructed punch for this purpose, it is shown in Fig. 9, and it worked very nicely and went through 1 in. steel as easily as through light iron.

Willie was quite anxious to secure one of the blanks and I gave him permission to take one just punched out, but he did not hold it any length of time, so he let go of the hot stuff right quick, but I picked up a couple of cool ones for him and took them with us to the steam hammer.

The hammer gang were making coal pick eyes, and as the method originated with yours truly I give it in detail. Fig. 10 is the bottom die, a flat top die being used. Fig. 11 showing the cap and mandrel. Fig. 12 the completed eye 1½x1½x10 in. mild steel being used for the purpose. The face being welded on and shaped and the pick end drawn out the last thing. Willie was greatly interested in the way the boy handled the hammer and wanted to have a try at it, but as I was called away to the pattern shop at this time I told him he could try it some other time and handing him the punch blank, told him to take care of himself until I got back. I was gone about an hour, as we were getting up some complicated dies for our Bulldozer. It was quite evident to me on my return that something had been doing in my absence, as the forging machine was shut down, and on investigating found the punch blank that I had handed Willie stuck in the cogs of the big gear wheel and pinion, it seems the boy had gone down to the machine to watch its operation. There was a platform behind the gear and pinion to better facilitate the oiling of the machine, and Willie had taken up his position there. A stream of water is used to keep the header cool, and it makes quite a report when the iron is unusually hot. When the next report was heard, Willie was so startled that he dropped the punching out of his hand and it lodged in the teeth of the gear. Luckily, no damage was done, but it took all the men we could get around the machine to back it off.

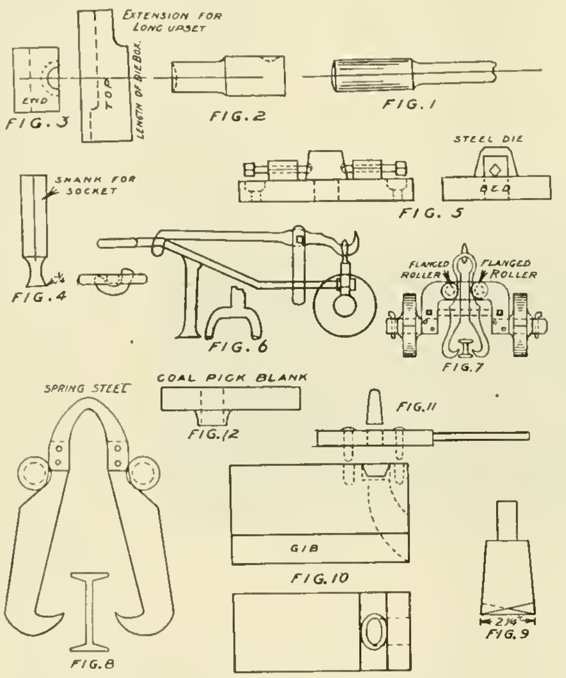
I then went in search of the boy and found him in my office with scratched face and bloody nose, the consequence of his efforts to make the hammer boy let him run the hammer. I had given the hammer boy positive orders not to let any one fool with the hammer. Willie, however, took the stand that he was his uncle's nephew and had a right to try his hand at it. The result was a battling Nelson-Jimmie Britt set-to on a small scale for the amusement of the men and the disfigurement of the principals, but no serious damage was done to either. Willie was taken home forthwith to recuperate and get ready for the fishing trip.

T. Toot.

The Air Pump Piston-Rod Swab.

Editor:

The benefit derived from the use of a good swab, kept saturated with oil, on the piston-rod of an air pump is considerable, and most engineers recognize



BLACKSMITHS' TOOLS AND APPLIANCES DESIGNED BY T. TOOT.

its value and take care of it. The piston-rod packing receives the greatest benefit from the swab no matter what kind of packing is used, but when metallic packing is used, a swab is indispensable.

There have been various kinds of swabs and swab-holders used. It is not the purpose of this article to discuss which of the various kinds is the best, but to describe a certain swab-holder, which, when it was first brought out, was thought to be the proper thing, but did not prove to be so in practice.

The swab-holder referred to was in the form of a casing, and was made in two parts, fastened together by four screws. Special stuffing-box nuts were used, and the casing was made to fit the nuts closely, when in place around the piston rod. A pipe connection was made from the casing to a suitable oil cup attached to one of the center piece bolts. The swab and rod, with this arrangement, was entirely covered and protected from dust. Metallic packing was used and the casing also prevented the stuffing-box nuts from backing off.

The casing appeared to be an ideal arrangement, and I believe that it would have proved to be, had the packing remained perfectly tight. Serious trouble was experienced, however, when the upper end began to leak a little steam into the casing, which, on account of the nice fit of the casing, was prevented from escaping to the atmosphere, and found its way into the air cylinder, and from the air cylinder into the main reservoir where it was condensed. In a short time sufficient water would accumulate so that water, in the form of spray, was carried by the flow of air back into the train pipe where it froze, and resulted after awhile in a frozen train pipe, the danger from which all the readers of Railway and Locomotive Engineering are well acquainted.

It was not until the general air brake inspector's attention was called to the trouble that was being experienced from frozen train pipe, with this particular engine, that the cause of the trouble was located.

E. G. Desoe.

Springfield, Mass.

"Caught with the Goods."

It is gratifying to those who are on the lookout for signs of prosperity in the country to hear that machine tools are selling freely at full prices. Such is the opinion of the *New York Commercial.* This paper affirms that the demand for machinery, and especially for machine tools, is increasing so rapidly that manufacturers are experiencing great difficulty in making shipments on time. Warehouse stock and show machines are being sold in the endeavor to meet the demand for immediate delivery.

Large projects are on foot and they are progressing favorably. To put them into effect considerable equipment is necessary and this equipment is being bought with short time for delivery. In many cases immediate delivery is being demanded and firms which are holding back in order to dazzle the world with some wonderful machine not yet quite perfected are not doing business, simply because immediate delivery of something which will do the work is the order of the day.

Improvements and extensions are being planned by most of the leading railway companies here and in Canada and as a result the machine tool makers who have stock to sell are busy, and especially those who have previously let the purchasing public know that they are ready to deliver the goods. The firms who have kept their names before the public in season and out of season are naturally the ones which receive the first bids. Now is the time to get into line.

Mr. Hill on Trade with the Far East.

The past and the present trade with the Far East, says James J. Hill, are trifling to what they will become after peace is established. In an interview with a contributor to *Success*, Mr. Hill remarked:

"From the time of the Phoenicians the commerce of the Far East has been a source of wealth to nations. It enriched Greece and Rome; it was the foundation of the power of Venice; it gave the Dutch a period of supremacy, and then it made England the greatest of commercial nations. But this trade will be, in the near future, far greater than any of the old merchants ever dreamed of. A very pertinent question just now is—are we prepared to get our share of it? We have increased our exportation of wheat to the Orient from thirteen million bushels, in 1893, to sixty million bushels, in 1903, which, I think, is an excellent showing, but we don't need foreign markets for our wheat nearly as urgently as we do for manufactured articles. In these, our trade with the East is at a standstill. Both Germany and England, and particularly the former, will doubtless get the lion's share of it unless conditions in the United States undergo a change. The Chinese are good people to deal with. Commercial honor is almost a fetich with them. But they are the shrewdest merchants in the world, and demand a reciprocity for their trade favors which our foreign rivals are in a much better position to give than we are."

Despite Mr. Hill's belief that wages have been raised to a fictitious standard, there has been only one strike on his railroad, the Great Northern, and this was settled to the satisfaction of the strikers. An interesting episode in connection with it is told by Eugene V. Debs, who led the agitation.

"President James J. Hill and I had shaken hands," said Mr. Debs, in relating the story, "and declared the hatchet buried. He said he was glad it was over, and assured me that he had no feeling of resentment. As we stood chatting in his office, he remarked: 'By the way, Debs, you'll have to be my general manager, to-night, for the men won't go to work except on your orders.' I replied:

"'All right; I'll guarantee that by morning the trains will all be running on schedule time.' Then Mr. Hill suddenly asked me:

"'How about my wages, Debs? I'm an employe, too, you know, and, since everybody gets a raise, where do I come in?' He laughed heartily when I answered:

"'Join the union, and we'll see that you get a square deal.'"

The first edition of our book, "Twentieth Century Locomotives," is exhausted. It is proving very popular and many of the purchasers have declared the book to be as good as a correspondence school course. The price of the new edition remains the same, viz., $3.00.

C. M. & St. P. Pacific Type Engine.

The Chicago, Milwaukee & St. Paul Railway have recently been building some 4-6-2 passenger engines at their West Milwaukee shops. Through the courtesy of Mr. A. E. Manchester, superintendent of motive power, and also of Mr. J. F. De Voy, mechanical engineer, we are able to give our readers some idea of what these neatly designed machines are like.

The engine we show is simple, with cylinders 23x26 ins. and 72-in. drivers, of which there are six. The drivers are equally spaced and the position of cylinders enables the designer to use a connecting rod 9 ft. 7 ins. long. All the wheels are flanged and the Davis method of counterbalancing has been followed The valve is a 12-in. piston type, having 6 ins. travel and driven by direct motion with transmission bar inclined at an angle and passing over the forward driving axle and joining the valve rod near the pin of a hanging rocker. The radius of the shifting link is 53 ins. The steam lap of this valve is 1 in., while the exhaust lap is $\frac{1}{8}$ in.

A. E. Manchester, Sup't Motive Power. PACIFIC TYPE FOR THE C. M. & ST. P. C. M. & St. P. R y. Builders.

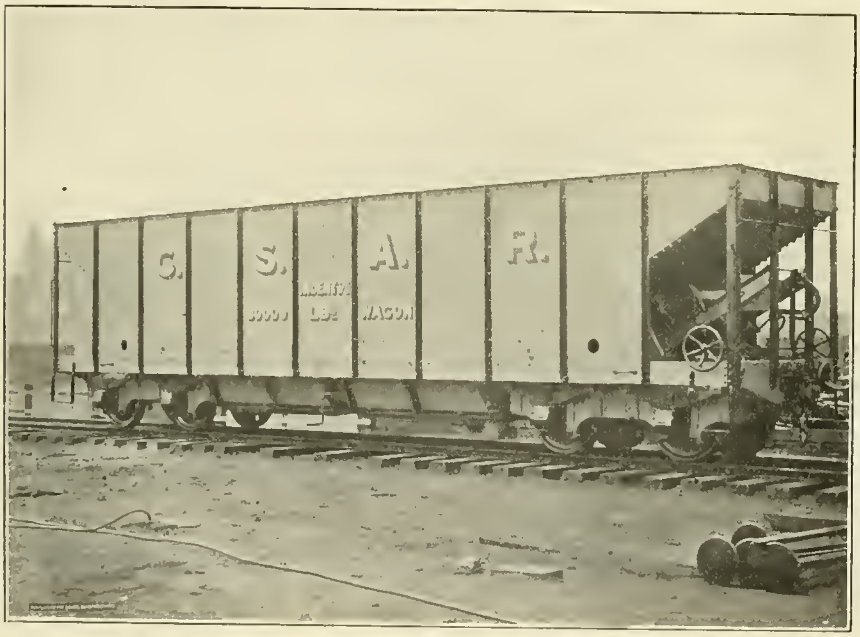
The boiler is a wagon top one, with the taper sheet at the second course. The first course measures 72 ins. in diameter. The crown and roof sheets are level and are radially stayed. The back and throat sheets are inclined at a considerable angle. The heating surface from the tubes is 3,136 sq. ft.; from the fire box 245.6, making a total of 3381.6 sq. ft. The grate area is 35 sq. ft. The tubes are 363 in number and are each 16 ft. 6 ins. long.

The tender is of the U-shaped type, with short water bottom below the fuel space. The tender trucks are ordinary arch bar trucks. The tank has a capacity of 7,000 U. S. gallons of water and 12 tons of coal. Some of the principal dimensions are appended for reference.

Boiler—Pressure, 200 lbs.; material, steel, ¾ ins.
Fire Box—½, ⅝, 5/16; 5 ft. 10½ ins. to 7 ft. deep, 3 ft. 5⅛ ins. wide; 10 ft. 5⅛ ins. l. g.
Steam Port—1⅝ ins.; exhaust port, 2½ ins.; driving journal, 9 x 12 ins.
Crank Pin Journal—Front, 5 x 4½ ins.; main, 6½ x 7 ins. and 7½ x 4¾ ins.; back, 5 x 4½ ins.; crosshead pin, 4½ x 4 ins.
Weight of Tender, 125,600 lbs.; on drivers, 130,500 lbs.; on engine truck, 44,250 lbs.; on trailer, 34,000 lbs.; of engine, total, 208,750 lbs.; engine and tender, 334,350 lbs.

Steel Hopper Car on an African Road.

Our illustration shows an 80,000 lbs. capacity steel hopper dump car used on the Central South African Railways. It is built of plate and structural steel shapes and was turned out by the Darlington Wagon & Engineering Company, Ltd.



SOUTH AFRICAN STEEL HOPPER CAR.

The axle boxes support semi-elliptic springs, the ends of which are secured by clips attached to the truck sides. The boxes work in jaws, but they are placed almost at the back of box. The truck sides are made of formed or pressed steel plates.

The hoppers discharge on each side between the rails. The side view of the car shows the fixed sides of the hoppers, the doors not being seen in the illustration. A worm gear operated by the crank handle in the center of the car moves the dumping mechanism and opens and closes the hopper doors.

The car weighs light, 36,500 lbs., and can take a load of 85,000 lbs., making a total of 121,500 lbs. The truck centers are 25 ft. 8 ins. apart, and the wheel base of each truck is 5 ft. The wheels themselves are 2 ft. 9½ ins. in diameter. The total height of the car from the rail is 9 ft. 9 ins. The body length is 36 ft. 6 ins., and the width is 7 ft. 6 ins. The journals are 10 ins. long and 5 ins. in diameter. The car is equipped with the Westinghouse brake and the brake and auxiliary reservoirs are carried on a suitable framing at one end of the car.

War on the Pullman Microbe.

The railway surgeons of the United States recommended, at their last annual convention, that three sheets should be used in each sleeping car bed. Two are placed as usual, one above and one below the sleeper, and the third to be used as a blanket-cover, for sanitary purposes. The Pullman Company is said to intend to make trial of the plan.

The idea that the three-sheet bed will foil the microbe is based on the belief that cold, clean linen is distasteful to him, and that when he, desiring to nestle snug in the warm blanket, will be confronted by the cold and uninviting sheet, and more than that, if he presumes to trespass on the cover-sheet, he will be rolled up in that sheet next morning and cast into a tub of scalding water, when he and the sheet reach the laundry.

The three-sheet bed has the further advantage of preventing the blanket from being soiled, and each berth will have a cleaner and sweeter appearance, and the not always pleasant odor from blankets will be prevented from arising in the car.

Fierce Fight on Front Foot Plate.

Some time ago an Ontario & Western fireman and a bald eagle had a fight on the front foot plate of a rapidly moving engine. A bald eagle somehow or other got on the railroad track near Poyntelle, Pa., and failed to notice the approach of a train until it was too late. The pilot struck the bird so forcibly and so suddenly that it was thrown on the front foot plate in a half stunned condition. It managed to hold on, but before it could thoroughly recover the fireman, who saw what occurred, went out along the running board and tackled the bird of prey.

The fireman was handicapped in his efforts to capture the eagle, as he had to hang on to the handrail with one hand and fight with the other. After the bird got its first wind, it was not handicapped at all, and gave a good account of itself, tearing the fireman's overalls and making things lively at the front end. The eagle was at last secured and brought into the cab still fighting. Here the engineer took a hand in, and after considerable fuss and feathers the "King of the upper air" was tied with a piece of bell cord. It was a noble specimen, and measured seven feet from tip to tip. The fireman took the disgusted eagle home in triumph, but the bird is going to warn its friends not to travel by the O. & W.

The Goose With the Golden Eggs.

The Pennsylvania Railroad are having one thousand refrigerator cars built and the Michigan Central have ordered five hundred. An order for eight hundred and fifty have been given by the Merchant's Dispatch, which is owned by the Vanderbilt lines. With these, and those already owned, the Vanderbilt lines will have over five thousand refrigerator cars.

These cars cost a good deal more than ordinary box cars, and the decision of these companies to use their own cars for the movement of fruit and other perishable freight, speaks volumes. There has been great dissatisfaction among shippers generally regarding the icing charges made by some of the private car lines. Evidence was submitted at the Interstate Commerce Commission inquiry, that in some cases as much as four times the cost of the ice and labor involved had been charged to shippers, and they had been compelled to pay. The railways furnishing these new refrigerator cars intend to let the shippers do their own icing, provided railway refrigerator cars are used. The action of the private car lines in thus providing a powerful incentive for railway companies to enter the field in which they had formerly a practical monopoly is only one more example of the policy of killing the goose that laid the golden eggs.

Private lines have not been any too ready to fall in with the practices of the railways over whose tracks their cars run. Some years ago the private lines were slow in accepting the M. C. B. car interchange rules.

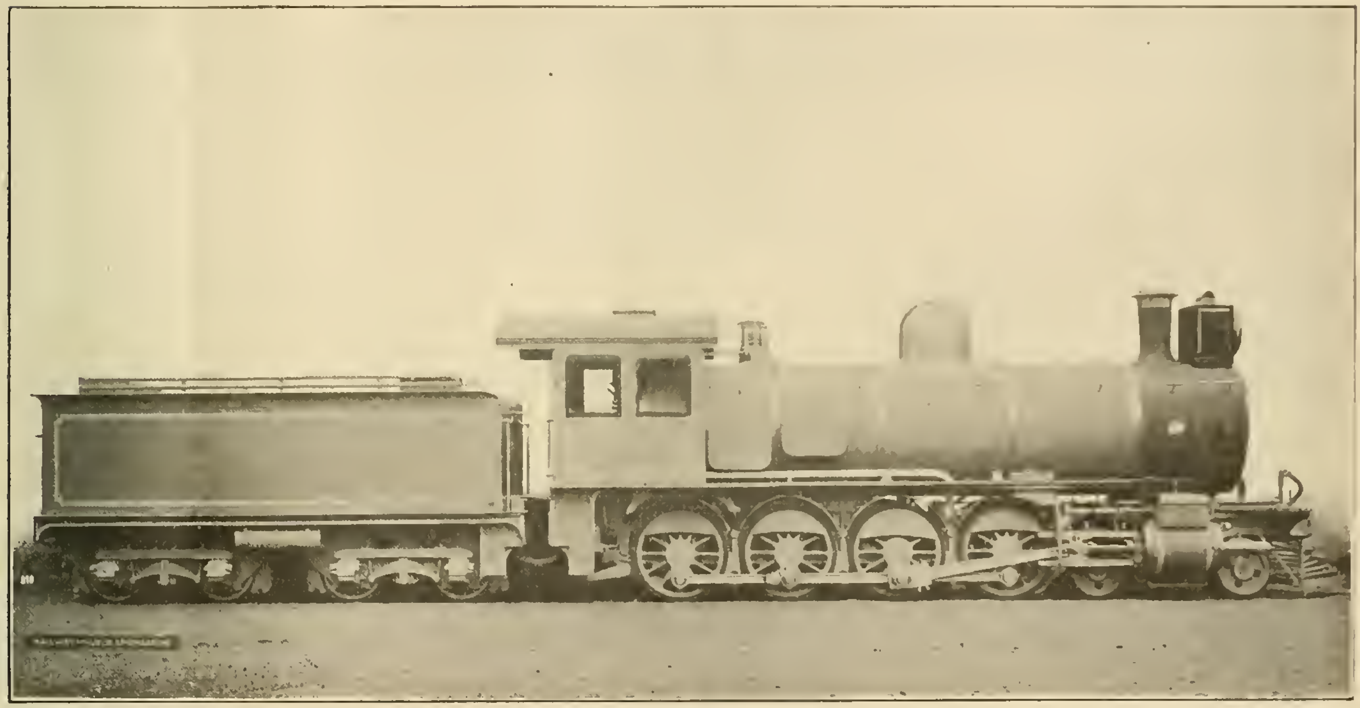
South African Twelve-Wheeler.

The 4-8-0 engine which forms the subject of our illustration is a neat specimen of its class. It is owned by the Central South African Railways, and was built by Nelson Reid & Company, of Glasgow.

The cylinders are 19x24 ins., the engine being simple. The driving wheels are 48 ins. in diameter and the tractive effort, when calculated with 80 per cent. boiler pressure, taken as the M. E. P. in the cylinders, is 25,992 lbs. The piston rods are extended through the front cylinder cover and are encased in pipe with rounded ends. The valves are ordinary D-slide and they are actuated by indirect motion. The sand boxes, one on each side, are neatly tucked away partly below the running board just over the leading driver. The wheels are all evenly spaced, which helps to give to the engine its symmetrical appearance. The drivers are flanged with the exception of the pair under the sand box, which have plain tires.

A noticeable feature about the boiler is the fact that the fire box is supplied with Drummond tubes which cross the front end of the fire box and are accessible by the removal of the manhole covers which are to be seen on the side of the boiler just beyond the cab. The Drummond tubes give 123 sq. ft. of heating surface, the fire box gives 125.4 sq. ft., and the ordinary fire tubes give 1,138.9, so that the total heating surface becomes 1,387. The grate area is 21 sq. ft. The boiler pressure carried is 180 lbs. to the square inch. From an American standpoint this engine is deficient of heating surface, but it is found in practice that the Drummond cross tubes greatly increase the efficiency of the heating surface.

The tender is mounted upon trucks having axle boxes which move up and down between very broad jaws, which are bolted to the truck sides. To carry the weight the truck side is fastened to an elongated spring band and from the ends of the semi-elliptic spring hangers run up to a flat bar-equalizer which rests upon the top of the axle boxes. These boxes have practically M. C. B. covers. The tank has a capacity of 3,000 Imperial gallons and 6 long tons of coal. The engine in working order weighs 60 tons 12 cwt., and the tender weighs 37 tons 19 cwt., which gives a total of engine and tender in working order of 98 tons 11 cwt. The tons in this case are taken at 2,240 lbs.



Philip A. Hyde, Loco. Sup't. SOUTH AFRICAN 4-8-0. Nelson Reid & Co., Builders.

Blessing the Tunnel.

The Simplon tunnel was formally opened April 2, 1905, with ceremonies which were more or less impressive. The tunnel has a double track through it, and two trains entered the tunnel at about the same time, one from each end. The train from the Italian end reached the center first, but soon the Swiss train got there too.

In the center of the tunnel there is a doorway connecting the two "tubes," and this space was shut by a tightly fitting iron door which originally confined the flow of hot water from a subterranean well, which at one time had threatened the progress of the work. The parties from the two trains alighted and shortly after the iron door was removed and Italian and Swiss engineers rushed into each other's arms, while others gave vent to joyful cries of "Long Live Switzerland," "Long Live Italy." Bands played the national anthems of both countries, and the Swiss bishop embraced the bishop from Italy. The Swiss bishop then preached a short sermon on the spot and blessed the tunnel.

Proposed Siberia-Alascan Railroad.

A press dispatch to the New York *Sun* from St. Petersburg says that a company of French capitalists propose to build a railroad between Siberia and Alaska, and to join the two countries by a bridge. The company apparently are not looking for financial aid or guarantees from Russia. The government of that country has been interested in the scheme, and intend to submit the proposal to a committee of experts, under the chairmanship of the Director of Imperial Railroads.

If such a road is ever built it will probably run through the northern part of the Siberian peninsula and reach Cape Vostolchni or East Cape, from which a bridge would have to be built across Behring Strait to Cape Prince of Wales on the Alascan side. That is the narrowest part of the strait, and it is only a few miles south of the Arctic Circle, which is 23½ degrees from the North Pole. That is the part of the world where the long days and nights begin, and if ever such a road is built there will be plenty to interest travelers.

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Editorial Change.

Our western editorial representative, Mr. Joseph A. Baker, has resigned, and leaves the paper April 30. Mr. Baker has proved to be a very valuable man and possesses the attributes that force success in whatever sphere of labor he devotes his energies.

Those who have been in the habit of corresponding with Mr. Baker direct will please in future address their letters to the head office, 136 Liberty street, New York.

Ratio of Dead Weight to Live Load.

In perhaps the majority of cases, if a sheet of ordinary office letter paper was weighed, and the envelope in which it came through the mails was also weighed, it would be found that on the average the envelope was about as heavy as the sheet of paper. If the letter cost two cents to deliver, it is obvious that the sender must have paid one cent for the transmission of his communication and another cent for the carriage of the envelope.

Applying this analogy to the transportation of merchandise, we may say that the envelope may readily represent the vehicle containing the goods, while the typewritten letter represents the live, or paying load. The car, stamped with the name of the owning road and postmarked with tare, capacity and equipment data, is hauled over the road for sole purpose of preserving the valuable contents intact and preventing their being tampered with while in transit.

In the days when a wooden car having a tare of about 20,000 lbs. was required to carry 20,000 lbs. of load, shippers paid a given rate for the haulage of their merchandise, and incidentally put the railroad company in for the haulage of an equal weight of material which was not capable of being turned into money at the end of the trip. No doubt the freight rate generally charged compelled the shipper to pay for the movement of the dead as well as the live load, but the arrangement was uneconomical because the ratio of dead weight to paying load was so high that if a shipper desired to forward 100 lbs. freight, 200 lbs. in all had to be taken over the road.

As the capacity of wooden cars increased and methods of construction and of car design improved, the tare became somewhat less in proportion to the weight of the paying load. When 60,000 lbs. capacity was reached, the steel car first made its appearance, and the ratio between dead weight of vehicle and paying load began to decrease, until at the present time with the modern steel car of high capacity an average of 25 per cent. of dead weight will answer for the transportation of 75 per cent. of paying load, especially where rough freight is concerned. The natural result of this is that in any train of given weight, the revenue producing load is so much in the preponderence, and the mere dead weight used to convey it comparatively small that a readjustment of freight rates was not only possible, but inevitable. A further economy in train operation at once appeared by reason of the fewer of these large cars hauled, and the consequent decrease in the amount of rolling stock necessary to conduct a given amount of traffic.

The large car and the big engine, whose evolution have gone on side by side, at length produced such a result as to justify Mr. Geo. H. Daniels, of the New York Central, in saying: "If our railroad rates were doubled, at which figure they would still be lower than those of any other country in the world, it would close almost every mill and factory in our country away from tidewater." It is evident from all this that the reduction of dead weight in proportion to the paying load which can safely be carried in any car is a most important factor in the transportation problem and it opens up a wide field for car design and construction capable of realizing the most satisfactory revenue producing results.

While it is true that in this country the ratio of dead weight to paying load has been reduced to a highly economical point, we are behind European practice in this respect when it comes to our best passenger equipment. The average weight of a twelve-section drawing-room and smoking-room Pullman sleeper is 124,000 lbs. The car will comfortably hold twenty-six people, when there are two people in each section and two in the drawing-room, and this means that for every such person carried in that car the railway hauls 4,769 lbs. of dead weight. The average weight of a sixteen-section sleeping car is 122,000 lbs. If thirty-four people occupy this car, as they would with two in a section and two in the state-room, we have a dead weight per passenger of about 3,588 lbs.

These figures may appear to represent too much waste space in the Pullmans, so in order to make the comparison fairer we will suppose twice the number of people are carried and that the car had been filled as it might be in day time. Taking an average between the dead weight hauled per passenger for the two classes of car, this would give about 2,039 lbs. per passenger. The Pullman car in America is used on all roads and thus may fairly be considered as a distinct type.

As an instance of the practise in Great Britain we may cite a 48-ft. bogie first-class carriage on the Caledonian Railway. First-class travel in the British Isles approximates more closely to our Pullman travel than our ordinary first-class day coach travel does. This vehicle has a total weight of 23 tons 11 cwt., or 52,752 lbs. The carriage holds 56 persons and the amount of dead weight hauled per passenger carried is 942 lbs. The average Pullman, therefore, contains a little over twice as much dead weight per passenger when filled to its day-time capacity as the Caledonian carriage which has been taken as an example.

We have been here only considering the ratio of dead weight to paying load and have given the figures for the interest which may attach to them. There are other conditions which would have to be taken note of if the comparison were intended to be full and complete in every particular. In this country on account of the long distances traveled and for other reasons, the style of coach is materially different from those of European countries. Our Pullmans are more like traveling hotels in which we sleep and dine and live, while the Caledonian carriage is simply a comfortable vehicle for short distance travel, without lavatories, passageways, smoking compartment, or any of the many conveniences which, though they add weight to the car and reduce its carrying capacity, enhance the comfort of travel in such a way that to us they are indispensable.

International Railway Congress Meeting.

The meeting of the International Railway Congress which begins at Washington, D. C., on May 3, is an event of very great importance to railways and railway interests of all kinds. The International Railway Congress is a most dignified and influential organization, with headquarters in Brussels, Belgium. It is composed of the leading railway officials and meets in convention once in five years to discuss the most important practical matters connected with railway management. All the past meetings have been held in European cities, and the highest dignitaries in the countries where the Congress met have felt honored to preside over the deliberations of men who exert such stupendous influence on the welfare of nations.

The meetings at Washington will last from the 3d to the 14th of the month, then the visitors will be given free transportation over all the railways on this continent, if they so desire. Had President Roosevelt been in Washington he would have taken part in the opening ceremonies and Vice-President Fairbanks will act in his place. The succeeding general meetings will be presided over by President Stuyvesant Fish, of the Illinois Central, because he is president of the American Railway Association, through which the arrangements were conducted that brought the International Railway Congress to this country. President Fish will deliver an inaugural address which is certain to be worthy of the occasion, for Mr. Fish is an earnest student of all the most important problems of railway management.

The work of the Congress will be carried on in five sections, so that the members and visitors may listen to or take part only on the subjects they are interested in. In the first section maintenance of way matters, which include rails and their fastenings, ties of all kinds, etc., will receive exhaustive attention. In the second section problems relating to locomotives of great power, pooling locomotives, automatic couplers, and electric traction will be discussed. In the third section the lighting, heating and ventilation of trains, automatic block systems, baggage and express parcels, and suburban traffic will be thrashed out. Section four will be devoted to slow-freight rates, bookkeeping, duration and regulation of work, and provident institutions, and the fifth section will be given to discussion of the influence of light railways on the main lines, direct financial co-operation by public authorities, organization of cheap service, and automobile traffic. These sections will meet at different hotels, the main meeting being held in the ballroom of the New Willard.

The American delegates to the Congress include the principal railway officials in the United States, Canada and Mexico.

In connection with this Congress a most elaborate Exhibition of Railway Appliances has been prepared under the supervision of the Railway Supply Men's Association, Messrs. Geo. A. Post, C. A. Moore and J. Alexander Brown being the leading spirits. The exhibition will cover over 90,000 square feet of space, a little more than two acres, which throws the mechanical convention exhibits entirely into the background.

The Value of Tail Rods.

The Camden and Suburban Railway Company has had some interesting experience concerning the value of piston tail rods. They have as part of their equipment two cross-compound condensing Corliss engines with cylinders 30½ and 52 x 42 ins.; each connected to an 800-kw. generator. The engines are exactly alike except that one of them has no tail rods and one of them has tail rods.

The engine without tail rods was installed three years ago, and the one having the tail rods was put in service two years ago. The engine with the tail rods has been the more economical of the two, and has practically cost nothing for maintenance during the two years it has been running. The bull rings have not been changed, and the tool marks are still to be seen on the bottom of the cylinder. A saving in steam consumption has also been one of the features of the engine with the tail rods, and it can be run at about 10 per cent greater capacity than the other.

In the three years which the engine without the tail rods has run, it has worn out two sets of bull rings and the low pressure cylinder has been worn down about 1-1/16 ins.

The success of the tail rods is attributed, by those in charge, to the fact that the tail rods used are very substantial ones, and have had adequate supports. In their opinion the good results obtained are gained by having a through rod from cross head to tail bearing, of sufficient strength, and slightly bowed upward, so that the weight of the piston will bring it straight, and at the same time give a fair bearing to the piston on the lower part of the cylinder.

This is the story of the performance of two similar stationary engines with large cylinders. It is true that locomotives have not got quite up to the size of cylinders with which the stationary engines were equipped, yet there seems to have been a very marked difference between the stationary engines having the tail rods and those not having them.

This subject came up for discussion in the Master Mechanics' Association in 1899, and there was considerable diversity of opinion among the members, as to whether tail rods on locomotives were satisfactory. The size of the cylinder seemed to have some bearing on the subject, and the fact that unlubricated extension piston rods would give trouble was one of the things which might have been expected. Adequate support for the tail rod, so that the piston could be kept in alignment at all times, and especially when the engine was drifting, appeared to be very necessary in the opinion of those who favored the use of the tail rods. Those using them practically said that poorly designed tail rods were bad, and to get results the best were none too good.

Repair Work on Monthly Appropriations.

There was one remark made to the New York Railroad Club by Mr. Charles Streicher in his paper on Railway Shop Management to which little or no exception will be taken. He said, in effect, nearly all railroads now purchase their locomotives and other rolling stock, but practically all roads maintain repair shops, not because they can do the work more economically than others, but because it is essential to have control of the work and so be able to handle emergency jobs in accordance with their knowledge of the requirements.

It is quite possible to do this work at minimum cost, but the absence of proper system in such matters often leads to high average charges per locomotive or per car. To meet such cases the speaker advocated the monthly appropriation plan for running a railroad repair shop. This system means the setting apart of a certain definite amount of money by the company each month for each division, and this amount is expected to be enough to pay for the labor and material necessary for the maintenance of equipment in the shops, yards and inspection points on the division, the hard and fast rule being that the total of the pay rolls and the cost of material must not exceed the specified amount, except in cases of emergency after satisfactory explanations have been given.

This method tends to curb extravagance and cuts out expenditures not immediately necessary and it furnishes the officers of the department with some sort of data upon which to base their demands for the company's funds. It is claimed for this system that it does not destroy individuality, but rather tends to develop inventive, executive and managing ability, and a man alive to the possibilities of the system may achieve results which will insure recognition.

Such a system, Mr. Streicher says, is not generally popular, and officers have need to educate their men and gain their co-operation. The success of the plan depends largely upon the appropriations being based on recorded facts, coupled with reasonable expectations. They must be made with full knowledge and consideration of shop facilities and local conditions, which are seldom exactly alike on different divisions.

When he speaks of recorded facts, the author of the paper means that it is necessary to have cost statements, including labor and material covering all classes of engines and cars, carefully summarized and averaged as to parts of equipment, and these statements are to be freely given to all concerned. There should be a monthly distribution of comparative average cost sheets per unit of equipment, covering the entire system.

To properly work out the plan we are told that the piecework system is essential. Estimates are made for repairs at so much apiece, and material is specified in pounds, tons, feet, gallons, etc., and if repairing and maintenance be carried out on the indefinite day work plan confusion and failure will follow. Division appropriations should be made in lump sums by the general executive officers, who should consult with the superintendent of motive power. Master mechanics and master car builders should not be held down to itemized appropriations. If these men are given reasonable appropriations and material allowances they may be expected to do the work under the existing conditions and with a certain amount of give and take, according to circumstances.

Under the monthly appropriation plan, failure is likely to follow the ill advised effort of officials who go into it with a view of making a record. Co-operation of the rank and file are necessary, and if the first appropriation is exceeded the matter must be examined impartially, and those responsible must be given a chance to redeem themselves. It is a mistake to cut the appropriation too low, or to hamper the master mechanic or the master car builder with interference. They should be given full swing, but intelligently encouraged to produce results with full appreciation of the difficulties in their paths.

The Work of the Chancetaker.

We have recently seen an account of a rear end collision on one of our important New England railroads. The collision resulted in the derailment of eight freight cars and the serious injury of the engineer of the forward train. It seems that a freight train had stopped on the main line, and the engineer of that train got under his engine to repair a breakdown. While under the engine a following train crashed into the rear of the standing train, broke up eight freight cars and pushed the standing engine ahead, and so injured its engineer as to necessitate the loss of one of his legs. Any one of several causes may have been at the bottom of this wreck, but it looks very much like the work of the Chancetaker.

The road may not have been protected by signals in the rear of the stalled train. The signals, if there were any, may not have worked properly. The flagman may not have gone back far enough. The engineer of the second train may not have acted on any indication to halt. The brakes may have failed to work. There are five things, any one of which may have been the cause of the trouble. We do not say accident, because things like this cannot be rightly called accidents.

The rear end flagman has so often been weighed in the balance and found wanting that it is about time he was disregarded as the sole safety appliance for a stalled train. Block signals, with home and distant indications, are now practically part of modern railroad equipment, and these must be supplemented with the highest possible grade of signal maintenance, coupled with the enforcement of that kind of discipline which insures their absolute and unquestioning obedience by all train crews. The failure of brakes to work is not to-day a valid excuse for railroad accidents. Almost the same remarks apply to brakes as to signals. To be of any real value they must be maintained at maximum efficiency; and by the time a man is entitled to sit on the right-hand side of an engine he should know how to handle air brakes and be fully aware of their condition on the train he is handling.

Somewhere in this collision there is the work of the Chancetaker. He may have been a high official or a negligent flagman or a careless engineer, or a combination of two or more, but his work is always the same, whether he does it alone or gets there in squads. One of the most pressing duties for railroad men of all ranks to-day is the elimination of collisions, front or rear; in yards or on crossings. Safe railroading is the thing which the American people are demanding and they mean to have it.

Gasoline vs. Electricity.

The Chicago & Alton Railroad Company have felt the effect of trolley line competition, and not long ago they put on a suburban service which was intended to meet the case. At present small engines are used hauling ordinary passenger coaches. The first of this class of train was run between Pontiac and Bloomington, a distance of about thirty-five miles, and also between Springfield and Girard, a distance of twenty-five miles.

These trains are run as often as are the electric cars, with which they compete, and the fares on the steam road are as low as on the trolley line. Stops are made at regular stations, and at all highway crossings and public institutions, so that passengers have nothing to complain of.

To still further reduce the cost of operation and to head off projected trolley lines as well as divide the business with the existing opposition lines, the Alton have given an order for six gasoline motor cars to be used in this service. In thus endeavoring to meet conditions and do as well if not better than their rivals this company have shown plain business sagacity. "It's the only way!" And the way that many other railroads ought to be following.

A Steel Car Fallacy.

What is a railroad collision? It is the violent coming together of two trains, either moving in opposite directions, or moving in the same direction, or one moving and the other not moving. The results are, as a rule, the same: destruction of life or of property or of both. There is one thing, however, that a collision is not the result of. It is not, and never will be, the result of locomotive or car construction. It is in every case the result of a failure in train operation.

Our friends of the daily press are very rightly insisting that something must be done to reduce the loss of life in railroad collisions. They point to the results of such an accident in which heavy Pullmans, steel cars and wooden vehicles are involved, and from the fact that wooden cars are generally badly crushed, they are advocating the adoption of steel cars as an antidote to the collision evil.

It is true that if collisions are one of the inevitable conditions of modern railroading, it is far safer for passengers to ride in Pullmans or steel cars. As things go now, the fact that such cars are safer than wooden ones rests on their very ability to crash into and wreck weaker ones. If all the cars in two violently colliding trains were equally strong what would happen to the passengers?

We can give some answer to this question by referring to a newspaper cutting recently sent to us by one of our readers, in which it was said that a train going fifty miles an hour had been stopped by its engineer in four rail lengths. Fifty miles an hour is at the rate of 76.6 ft. per second. Four rail lengths is 120 feet. If the train was not stopping, it would pass over the four rail lengths in less than two seconds. It is, of course, obvious that this newspaper statement is incorrect, but what about the loose passengers in a train so stopped? They would be thrown with excessive violence against the ends and the interior furnishings of the car, and severe injury to them would result.

If two non-telescopable, indestructible steel car trains came together at high speed the stopping of each train would take place in considerably less than four rail lengths, and some of the cars would be up-ended or violently wrenched to one side, or one or both of the trains would rebound with considerable force. The passengers in these cars not being fixtures and having at the time of collision the velocity of the moving trains, would be thrown about with a degreee of violence only measured by the speed of the trains and the staying qualities of the cars.

We do not say that steel passenger cars are not a most desirable form of railroad vehicle construction. They would be most valuable in such contingencies as derailments or such like wrecks, for they would stand an enormous amount of side wiping against tunnel walls or the slopes of rock cuts where they had space to stop in. When it comes to the violent straight-away collision, something must give, and the success of the heavy Pullman or the all-steel car has so far depended, almost entirely, on the presence in the trains of cars that can be crushed or broken to fragments.

Book Reviews.

Modern Gas Engines and Producer Gas Plants, by R. E. Mathot, M.E. Publishers, the Norman W. Henley Company, New York. 1905. Price, $2.50.

This book is simple, instructive and up to date. It is intended to be a guide to the gas engine designer, user and engineer, and to aid him in the construction, selection, purchase, installation, operation and maintenance of gas engines. The author has discussed his subject fully and clearly without the use of mathematics.

The book contains 303 pages and is well illustrated throughout with line cuts and diagrams. There are fifteen chapters. The first nine of them deal with the gas engine, from all points of view. The next four are devoted to producer gas and producer gas engines, and the last two take up oil and volatile hydrocarbon engines and the selection of an engine. The results of a series of tests are given at the back of the book, and a good index is also to be found there. The author of this book is a consulting engineer who has made gas engines a special study. He treats the subject from the standpoint of the best modern American and European practice.

"Alternating Current Machinery." By William Esty, head of the Department of Electrical Engineering in Lehigh University. Publishers, the American School of Correspondence at the Armour Institute of Technology, Chicago, 1905. Price, $3.75.

This book is written primarily for the practical man, but can be read with profit by anyone interested in the subject, even though he may not possess a working acquaintance with higher mathematics. In fact one of the reasons why this book has been prepared is to deal with the subject without the aid of mathematics. Graphic or geometric methods rather than analytical or algebraic methods have been adopted whenever possible.

In the opening sections the essential features of the source of alternating currents and the alternator are taken up. Next follow a description and discussion of the instruments used to measure alternating current, electromotiv force and power. The subsequent sections deal with the physical theory of each class of apparatus, the applications, behavior and operation of this apparatus, the structural details of commercial types and the methods of making the usual tests and calculations based thereon.

The book is neatly bound in half morocco, and is well illustrated with halftones and line engravings. There are 412 pages 9x6 ins. and a good index at the end of the book facilitates the work of the student.

How to Mix Paints. By C. Godfrey. Publishers, The Industrial Publication Company. New York, 1905. Price, 50 cents.

This book contains fifty-three pages of reading matter and they are 7½x5 ins. in size. It is a simple treatise, prepared to meet the wants of the practical painter. There are illustrations of the tools and appliances used by the paint mixer.

Notes are given about tints and shades, use and care of brushes, hints on displaying colors, color harmony, etc. The information given in this book is practical and simple, and the directions are written so that those who have not had a very extensive training in mixing colors may yet be able to do good work in that direction.

A very complete index at the back enables one to easily find the directions for mixing any desired tint or shade.

Engineer's Influence on Fireman.

Last month we gave an abstract of the admirable paper read by Mr. W. S. Blyth on Locomotive and Train Handling, before the Canadian Railway Club. In discussing the subject, Mr. A. A. Maver, master mechanic on the Grand Trunk System, endorsed the speaker's views as to the influence for good which an engineer can exert upon his fireman.

Among other things Mr. Maver said: "I remember, when I was in charge of a large terminal, having a freight engineer who had received his training in England, where they give much closer attention to economy in fuel than they do here, although not perhaps so much in regard to ton-haulage. The schooling which he had received in England he put into effect in Canada, with the result that the monthly bulletin showing fuel consumption always showed this man the lowest in fuel consumption per car mile. Month in and month out, firemen might come and firemen might go, but he was always lowest in fuel consumed; and it was noticed that firemen who had received their training under him and went into passenger service always gave first-class service in passenger work."

May Meetings and Conventions.

The International Railway Congress meets on May 3 in Washington, D. C. The session will last until May 14. The spring meeting of the American Society of Mechanical Engineers takes place in Chicago, May 31, and lasts about four days. The Association of Railway Claim Agents meets in Boston during the month of May. The Association of Railway Telegraph Superintendents holds its annual meeting on May 17 at Chattanooga, Tenn. The Eastern Railroad Association holds its annual meeting on May 10 in New York. The Freight Claim Association meets in Philadelphia on May 17. The International Railway Master Boilermakers' Association meets May 16 in Buffalo, N. Y. The National Association of Car Service Managers meets in Washington, D. C., during the month of May, and the Railway Storekeepers' Association holds its annual meeting in Chicago, May 22 and 23.

The most unsafe way to send money is to put the coin in an envelope. Some of the quarters sent in this way slip out accidentally while others are helped out by dishonest people. Postage stamps are safer than coin, but a money order is best.

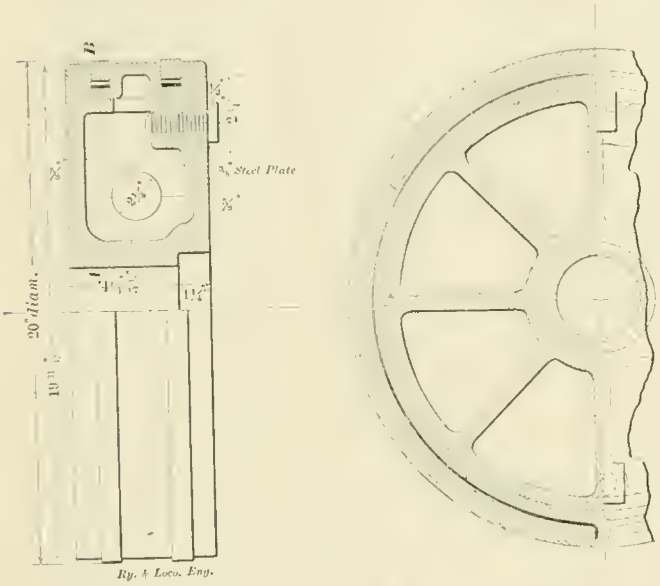
When Colonel Henry Waterson, the famous editor, returned from the Confederate army, he landed in Cincinnati destitute. Having an idea that he was adapted to newspaper work he proceeded to apply for a job. At one office he was told by the managing editor that the staff was full, but that there was always an opening for an unusually good man. He got that position, and before long was managing editor.

Uneven Cylinder Wear.

JOSEPH A. BAKER.

Many theories have been advanced at various times as to the cause of cylinders wearing more at the top than at the bottom and usually the theorists have concluded that the piston and guides were not lined up properly.

That these deductions were purely imaginary and not based on facts, I am fully convinced after a recent visit to the Missouri, Kansas & Texas Railway Company's shops at Parsons, Kan. Numerous cylinder packings have been experimented with in the past four years on the Katy, and the final decision rendered in favor of the Murphy packing, the invention of an old and experienced machinist in the Parsons shops. He has worked on the same principles and on the same lines as the Dunbar packing, producing a packing that is simpler, with fewer parts, less expensive, requiring less skill to apply and giving perfect results.



PISTON PACKING USED ON THE M., K. & T.

Investigators into the cause of the greater wear of the upper wall of the cylinders have found that the wear was always present where the ordinary packing ring, consisting of one piece, had to be sprung into place, but the investigation usually ended at this point. We know it to be a fact that with this type of packing steam enters under the ring at the stop pin at the bottom of the piston, passes upward and exerts its greatest pressure forming a fulcrum at the top of the piston and ring. It naturally follows that there must be greater friction there and necessarily more wear at that point.

The detailed drawings show the Murphy packing as applied to a Katy engine. The spring, only half of which is shown, encircles the piston and is made of steel ⅛ in. thick and of suitable width to be an easy fit in the ring cavities of the piston. It is formed and tempered to a circle 5 ins. larger than the cylinder with both ends turned down. These points act as supports to the ring which is cut into three equal sections and keeps the joints, which are faced and steam tight, in contact as long as there is anything of the rings left. With this arrangement the wear of ring and cylinder is uniform, as the expansion is the same at all points.

To verify the claims made for this packing I secured records of several engines which showed abnormal wear in their cylinders with the ordinary packing and which since the change of packing have caused no expense and occasioned no trouble to the Katy. Engine 296, Atlantic type, 19x26, carrying 180 lbs. steam, usually had the packing renewed every month. In January, 1903, she received the new packing and worked continuously until January, 1904, when she was shopped for general repairs. The packing was then removed and without any renovation applied to 191, an engine notoriously hard on cylinders. This engine is still in service and the packing has never been reported.

Engine 302 of the same class and with an equally bad record for cylinder wear got a set in June, 1903. In November, 1904, she went to the shops with a record of 118,769 miles to her credit, 1/32 in. wear to her packing, none to her cylinders, and no report of packing failure during her service.

The reader may think this a "fish" story, but the official records of Superintendent of Motive Power O'Herin and Mechanical Engineer W. H. Maddock, will verify my statement. Incidentally they may prove to you the necessity of a practical demonstration to a theoretical solution.

Authority.

During the dull season the road master had issued instructions to his section foreman to reduce forces according to orders, and one boss in particular had orders to lay off several men, which only left him one man and himself with the rest of the pick handles. The morning after he and his "man Friday" had got out the car and were preparing for the day's work, he would constantly take out the road master's letter and glance over it and remark, "I have laid off several men and I don't like to say anything, but if things ain't different I will lay off some more." They started out, and that evening, after a hard day's work, they were riding home on the hand car, he, the boss, and his one and only and lone man. The section boss, however, saw fit to remark, "I don't like to mention any names, but there's somebody on this car who is not doing his share of pumping."

Shop Extensions on the P. & R.

The Philadelphia & Reading are making some improvements to their already extensive repair shops at Reading, Pa. One of them will be an addition of 220 x 120 ft. to the main shop. A new building is being put up on the west side of the main shop. It will measure 540 x 60 ft. and will be for storage purposes. It will be open at the sides but will be substantially built and contain several overhead electric cranes. The Reading has bought a large number of new machine tools, which are being rapidly installed.

The wheel department is to be moved to the East Penn shops, and the space now devoted to wheel work will be utilized for the placing of machine tools. The company are bending their efforts to make the repair shop at Reading one of the most complete to be found anywhere in the country, and when all the contemplated improvements have been made the officials consider that they will be fully able to successfully cope with the repair work on that busy road.

Freight Equipment for the Erie.

Within the past few weeks car builders have delivered to the Erie Railroad more than half of the 5,900 freight cars recently ordered for use on that road. These deliveries include 1,072 hopper-bottom cars, 1,500 box cars, 975 gondolas and 281 refrigerator cars, all of which have now been put in service on the Erie and its branches. The cars are of the latest design and of the best steel construction. These with the 137 heavy freight locomotives now being built and in course of delivery, will aid materially in the handling of the traffic which is now so pressing that the company has to keep constantly in active service every locomotive and car they own.

Seventy-five locomotives were turned out at the West Albany shops during the month of March, thereby establishing a record. A new Bradley hammer has been placed in operation and a shavings exhaust system installed. An immense lathe which will cost $15,000 is soon to be placed in operation at the shops. The lathe is being built by the Niles-Bement-Pond Company, of New York.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. When a student wishes to receive a private answer, he is reminded that it is usual to send a stamped envelope for the return letter. We will be glad to answer any question relating to railway matters, but prefer that they be suitable for our question and answer department. All letters intended for Our Correspondence School ought to be addressed to Department E.

Progress of Our Educational Course.

We find that our educational course is proving very popular with enginemen, and a very encouraging sign is that in various places classes have been formed for the purpose of studying the lessons by mutual help. This is an excellent move, for one man may labor hard over a problem or question and fail to master it, while a little help from another student may make it plain. On the other hand, the man who stumbled over one question, will be able to help his associates over other difficulties.

If anything in the course proves too difficult for any person to understand, he will receive willing private help from this office by writing for it. The men who are carrying on the instruction have all had to educate themselves by the kind of self-denying perseverence that resorts to what is known as "burning the midnight oil," an experience that is pleasant to talk about, but is far from agreeable during the ordeal. Men who have gone through this experience may be depended upon to give sympathetic help to those brothers who are struggling along on the thorny path of self-help.

The instruction on air brakes which we have now entered upon, may be safely regarded as entirely up to date. Those who give careful attention to the questions and answers and digest them properly, need have no apprehension in standing an examination on air brakes by any set of railway officials.

Air Brake Questions—Second Series.

Q. 1. Why is the present brake called the automatic brake?

A. Because it is automatic in its action; that is, its normal condition is when it is held off, due to the maintenance of train line pressure, and anything which happens to reduce train pipe pressure will cause the brake to apply of its own accord, or automatically.

Q. 2. Where is the compressed air stored?

A. In the main reservoir on the engine; in the train line which extends throughout the train, under the cars and connects the brake valve with the triple valves; and in the auxiliary reservoir under each car.

Q. 3. What are the functions of the auxiliary reservoir, train pipe, triple valve and brake cylinder?

A. The auxiliary reservoir holds a storage of compressed air for supplying the brake cylinder with pressure with which the brake piston is pushed out, engaging the system of levers which brings the brake shoes up against the wheels and supply braking power. The train pipe stores a quantity of compressed air which holds the triple valve in release position normally; but when the train pipe pressure is reduced, the triple valve will shift and apply the brake. The triple valve performs a three-fold function. When in release position, it permits a charge of pressure to pass from the train pipe into the auxiliary reservoir. In application position, it permits pressure to pass from the auxiliary reservoir into the brake cylinder. In release position, it permits pressure to discharge from the brake cylinder to the atmosphere. Thus air passes through the triple valve three times. The brake cylinder receives pressure from the auxiliary reservoir in service application, and from both train pipe and auxiliary reservoir in emergency application, which pushes out the piston and applies the brake.

Q. 4. Where does the pump deliver the air?

A. To the main reservoir on the engine.

Q. 5. Where does the main reservoir pressure begin and end?

A. It begins with the discharge valves of the air pump and ends at the rotary valve of the engineer's brake valve.

Q. 6. What is excess pressure?

A. That amount of pressure contained in the main reservoir higher than that in the train line, available for releasing brakes.

Q. 8. How should a brake be cut out?

A. By turning the stop cock in the branch, or cross-over pipe.

Q. 9. How should the handle of cut-out cock stand when closed?

A. Parallel with the pipe.

Q. 10. How should handle of the angle cock stand when closed?

A. At a right angle with the pipe.

Q. 11. What does line, or mark, at end of plug cock indicate, regardless of position of handle?

A. This line, or mark, indicates the direction of the passage way through the plug cock, and by it may be known whether the cock is open, regardless of the handle itself.

Q. 12. How should a brake be "bled" off?

A. The release valve should be sharply opened for an instant, then quickly closed. This operation may be repeated until the triple valve begins to discharge the air, which can be heard at the retaining valve or exhaust port of the triple, then no further opening of this valve should be made.

Q. 13. When should the brake valve be used in the emergency position?

A. Only in extreme emergency cases to prevent accident, such as loss of life or property, then the handle should be placed in the emergency position and left there until the train stops or the danger of accident is over.

Q. 14. What does the red hand on the air gauge register?

A. Main reservoir pressure.

Q. 15. What does the black hand register?

A. The pressure above the equalizing piston and in chamber D. This pressure may be properly classed with train line pressure.

Air Brake Questions and Answers. Third Series.

AIR PUMP.

1. Explain how an air pump should be started and run on the road?

A. It should be started slowly to permit the condensation to be drained off. The lubricator should be started carefully, and the pump worked slowly until about 40 lbs. has been accumulated in the main reservoir to cushion the steam and air piston of the pump. Then the throttle should be opened wider, giving a speed of about one hundred and thirty or one hundred and forty single strokes per minute. The amount of work being done really governs the speed of the pump.

2. How should the steam end of the pump be oiled?

A. By the sight-feed lubricator, with a good quality of valve oil, and at the rate of about one drop per minute. This amount will vary with the condition of the pump and the work being done.

3. How should air end of a pump be oiled, and what lubricant should be used?

A. High-grade valve oil, containing good lubricating qualities and no sediment should be used. A good swab on the piston rod will help out a great deal. Oil should be used in the air cylinder of the pump sparingly but continuously, and it should be introduced on the down stroke, when pump is running slowly, through the little cup provided for that purpose, and not through the air suction valves. An automatic oil cup, such as has recently come into practice, is preferable to hand oiling.

4. When first admitting steam to the 9½-in. pump, in what direction does the main valve move?

A. If the main piston is at the bottom of the cylinder, as it usually is after steam has been shut off and gravity controls it, the main valve will move to the position to the right.

5. With the main valve to the right, which end of the cylinder will receive steam?

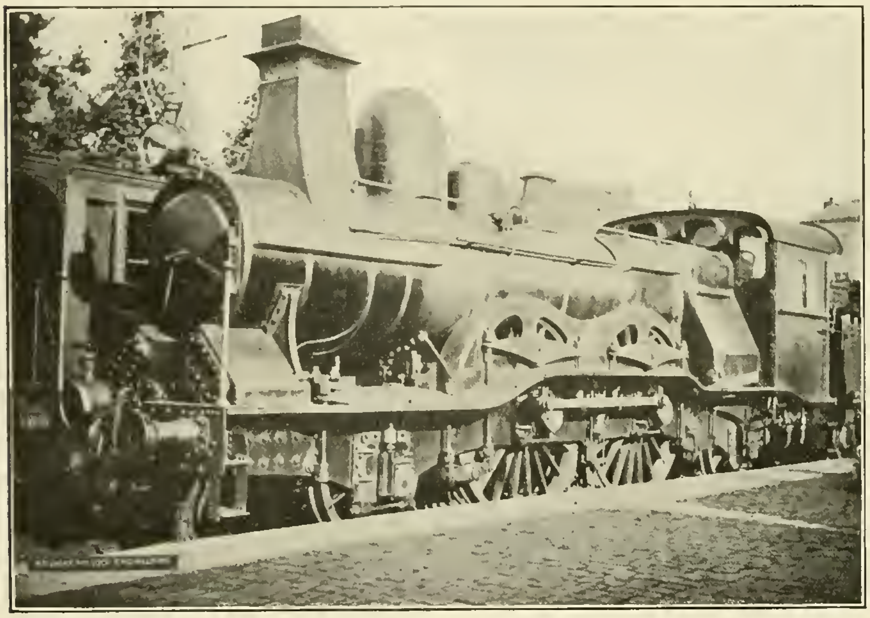
A. The bottom, or lower, end.

6. When the main piston completes its up stroke, explain how its motion is reversed so as to make the downward stroke?

A. When the main piston reaches and is nearly at the top of its stroke, the reversing plate catches the shoulder on the reversing valve rod, moving the reversing rod and valve to their upper positions, where steam is admitted behind the large head of the main valve, forcing this main valve over to the left, carrying with it the slide valve which admits steam to the top end of the cylinder and exhausts it from the bottom end, thereby reversing the stroke of the pump.

7. Explain the operation of the air end of the 9½-in. air pump on an up-stroke and on a down-stroke?

A. The air piston is directly connected with the steam piston, and any movement of the steam piston will consequently be transmitted directly to the air piston. When the steam piston moves up, the air piston will, of course, go with it, thus leaving an empty space or a vacuum in the lower end of the air cylinder, underneath the air piston. Atmospheric air rushes through the air inlet, raising the lower receiving valve, and filling the bottom end of the cylinder with atmospheric pressure. At the same time the air above the air piston will be compressed. The pressure thus formed holds the upper receiving valve to its seat, and when a little greater than the air in the main reservoir, the upper discharge valve will lift and allow the compressed air to flow into the main reservoir. When the piston reaches the top of the stroke its motion is reversed, and on the down stroke the vacuum in the upper end of the air cylinder is supplied by atmospheric pressure passing through the upper receiving valve. The main reservoir pressure is held by the upper discharge valve, and the air being compressed in the bottom of the cylinder holds the bottom receiving valve to its seat, and when compressed sufficiently, forces the lower discharge valve open and passes to the main reservoir.



BELGIN INSIDE CYLINDER ENGINE, OLD STYLE. PROTOTYPE OF OUR ATLANTIC TYPE ENGINE.

8. Give some of the causes of the pump running hot?

A. First, air cylinder packing rings leaking. Second, discharge valves stuck closed or the discharge passages so obstructed that the pump will be pumping against high air pressure continually. Third, poor lubrication. Fourth, high speed. Fifth, discharge or receiving air valves leaking. Sixth, air piston rod packing leaking.

9. If the pump runs hot while on the road, how would you proceed to cool it?

A. First, reduce the speed of the pump, and look for leaks in the train line. Second, make sure that the packing around the piston rod is not too tight and in bad condition. Third, see that the main reservoir is properly drained. If the pump still runs hot it should be reported at the end of the trip.

10. If the pump stops, can you tell if the trouble is in the pump or in the governor?

A. Yes. It may be tested by opening the drain cock in the steam passage at the pump, and noting whether there is a free flow of steam; if so, there is a free passage through the governor and the trouble is not there.

11. State the common causes for the pump stopping.

A. There are several reasons. First, it may be stopped by the governor being out of order; second, the valves may be dry and need lubrication; third, nuts may be loose or broken on the piston rod or one of the pistons pulled off. Fourth, the reversing valve rod may be broken, or bent, or the reversing plate may be loose, or the shoulder on the reversing valve rod, or the reversing plate may be so badly worn as not to catch and perform their proper functions. Fifth, nuts holding the main valve piston may be loose or broken off; sixth, excessive blow past the packing rings of the main valve.

12. Should a pump make a much quicker down stroke than up; what defect does it indicate?

A. An upper discharge air valve leaking, a lower receiving air valve stuck to its seat, or broken.

13. Should it make a much quicker up stroke, what defect does it indicate?

A. The lower discharge valve leaking badly, or the upper receiving valve is probably broken, or stuck to its seat.

14. Should an engineman observe the workings of a pump on the road, and report repairs needed, and do you consider yourself competent?

A. Yes.

GOVERNOR.

15. What is the function of the air pump governor?

A. To properly regulate the pressure in the main reservoir.

16. Explain how the governor operates.

A. The governor is an automatic arrangement for admitting and closing off steam to the air pump, and is actuated by air pressure. The steam valve, which shuts off and opens up the steam passage way to the pump, is controlled by an air piston and spring. When air pressure is admitted above the piston, it forces the piston down, closing off the steam to the pump. When the air pressure is exhausted from above the piston, the spring forces the piston up and allows steam pressure to pass to the pump. The admission and exhaust of the air to this piston is controlled by a diaphragm and spring. The air from the main reservoir enters the body of the governor underneath the diaphragm, which is held by a spring of given tension, depending on the pressure desired in the main reservoir. While the main reservoir pressure is less than the pressure the governor is set for, this diaphragm is held down by the spring, and the air can pass no further than a small pin valve attached to it, but when the main reservoir pressure overcomes the tension of the spring, it raises the diaphragm, unseats the pin valve and allows the air to flow to the top of the air piston, shutting off the pump. During the time the air is acting on this piston some of it escapes through a large leakage port, which is always open. When the main reservoir pressure drops below the pressure the spring is adjusted to, the spring forces the diaphragm down, seating the pin valve and allowing the air on top of the piston to escape to the atmosphere, through the small vent port.

18. Why is it necessary that the relief port in the improved governor be kept open?

A. If this port is not kept open, the air pressure, which holds the piston down, cannot escape when the diaphragm valve closes, and consequently the governor will not operate the pump properly.

19. Where would you look for the cause, if the governor allowed a very high main reservoir pressure to accumulate, especially in winter weather?

A. The main reservoir pressure may not reach the governor, due to the stoppage in the pipe, or in the union at the governor. This may also be due to the space on top of the diaphragm being filled with dirt. If the air is getting to the diaphragm valve, and is so indicated by the blow at the leakage port, the trouble must then be due to the drip pipe being stopped up or frozen, thereby preventing the air and steam, which leak in under the air piston, from escaping.

20. If the pin valve in the governor leaks, what effect will it have on the pump?

A. It will allow a certain amount of air pressure to flow in on top of the air piston. If the leak is greater than the escape from the little leakage port, the under pressure will accumulate, and cause the governor to slow down or completely stop the pump.

21. How can you tell if the pin valve leaks?

A. It will blow continually at the leakage port while the pump is running.

MAIN RESERVOIR.

22. What harm is there in allowing water to accumulate in the main reservoir?

A. It reduces main reservoir capacity or space which should be employed in storing air pressure for releasing and recharging the brakes. The moisture also is carried in the air, goes back into the train pipe, and gets into the triples, where it freezes in cold weather.

23. How often should the main reservoir be drained?

A. After each trip.

24. Where does the main reservoir pressure begin and end?

A. It begins at the top side of the discharge valves in the pump and ends on the top side of the rotary valve of the engineer's brake valve.

25. What is the main reservoir used for?

A. It is a store house, or storage tank for air pressure, to charge and recharge the air brakes.

26. What pressure is usually carried in the main reservoir?

A. 90 lbs. with the 70 lb. brake, and about 130 lbs. with the high speed or 110 lb. brake.

MODERN RAILROAD SIGNAL BRIDGE. LINE CLEAR!

GENERAL Questions Answered

LOCOMOTIVE COUNTERBALANCING.

(51) H. H., Tuelahoma, Tenn., writes:

My superintendent claims that the engine I am running is harder on bridges than any other engine he has on his division. The engine is the same class as all the rest of them, Rogers ten-wheel. He claims this engine is out of counterbalance. I would like to hear from you on the subject. A.—Your superintendent has probably got the right idea about your engine, and it should be weighed up at once. It is quite possible to have an engine one of a class out of balance, and the rest not so by reason of perhaps the loss of all or some of the weight which had been added at the time she was counterbalanced in the shop, or a mistake may have been made from the beginning in doing the work.

AIR PUMP POUNDS.

(52) F. M., White Sulphur Springs, Va., writes:

I am using a Westinghouse 9½-in. air pump. It has been in service about two years since repairs were made. About one month ago it began to show a pound at the beginning of the up stroke, which has grown worse, but pump makes plenty of air. The pound is not noticeable for about two strokes before the governor shuts it down, nor is it noticeable when the pump is working light. Where must I look for the trouble? A.—Your lower discharge valve or upper receiving valves have too much lift. They should be 3/32 in. Possibly, some of the air passages are choked with burnt oil. Run a strong solution of lye through the air cylinder of the pump, and note the lift of the air valves.

ALTERNATE APPLICATION AND RELEASE.

(53) W. H. T., Portland, Ore., writes:

A locomotive coupled to one coach, when coach was fully charged with air and engineer's valve on lap, the tender brake commenced to go on slowly. The piston traveled out 3 or 4 ins., then it would go back to zero, slowly, repeating this three or four times a minute with the regularity of clock work. It would also do so when the pump was stopped and engineer's valve in release position, but not when pump was running. When cut loose from the car, sometimes the brake would and sometimes would not go on. All Westinghouse equipment of 1890, tender and engine triple valves, plate D-20, engineer's valve D-8, coach triple valve quick-acting, plate D 22. Please give the probable combination of defects and the action of the triple to cause the driver brake to act as above stated. A.—This action is common in two ways: one, when the brake releases through the triple valve at the exhaust port, and another when the piston goes to release position in the brake cylinder, due to leaky leather packing or the escape of air through the leakage groove. In the first instance alternate applications and releases will result when there is a combination of train pipe leakage and brake cylinder leakage, and particularly so when accompanied by a stricture in the train pipe, such as partially closed cut-out cock, etc. The train pipe leakage will cause the triple to go to graduating position and air to leave the auxiliary and go to the brake cylinder faster than air leaks from the train pipe, and especially so if there is a leakage of auxiliary reservoir pressure past the graduating valve and slide valve in application position. The result will be that the triple will go to release position and the brake will whistle off. In the second case, the train pipe leakage causes the triple to go to graduating position and send auxiliary reservoir pressure to the brake cylinder shoving the piston out. Brake cylinder leakage allows the piston to return to release position gradually until another movement of the triple valve, graduating position, will send more air from the auxiliary reservoir to the cylinder, when the operation will repeat itself.

PRESSURE IN AUXILIARY DOME.

(54) J. R. F., Montreal, Can., writes:

Kindly tell me the pressure that will be exerted against the valve and whistle dome at 200 lbs. boiler pressure. The opening into this auxiliary dome is 3¼ ins. diameter? A.—There will be 200 lbs. per square inch on the whistle valve and 200 lbs. per square inch against the top of the auxiliary dome. This is a static pressure and it will be 200 lbs. per square inch on all surfaces to which the steam has access so long as it is not drawn off in large volume.

CALCULATED TRACTIVE EFFORT.

(55) Coal Scoop, Vancouver, B. C., asks:

Has the calculated tractive effort of a locomotive anything to do with the total weight of the engine, or with the weight on the drivers? A.—The calculated tractive effort of a locomotive does not take total weight or weight on drivers into consideration. The formula deals only with cylinder area and stroke, mean effective pressure of steam in the cylinders, and diameter of driving wheels. The rule is, square the diameter of the cylinder in inches and multiply the result by the stroke in inches, and multiply this second result by the M. E. P. in the cylinders in pounds per square inch (usually taken as 85 per cent. of full boiler pressure) and divide the whole by the diameter of the driving wheels in inches. This gives the starting power in pounds and is equal to the weight a locomotive could pull up out of a well with suitable frictionless single rope and pulley attachment, which does not multiply power. The question as to whether the engine can do this without slipping is determined by the weight on the drivers, and designers, knowing this weight, must use cylinders, pressure and wheels to suit. If the tractive effort is about 1/5 of the weight on the drivers, the engine will not slip on a good dry rail. Some designers let it go at 2/9, and others as high as ¼, being willing to permit the chance of a little slip at the start where sand can be used, because when hooked up an engine does not develop her maximum tractive effort.

SPECIAL COMBINATION 25 LBS. AND 50 LBS. RETAINING VALVE.

(56) R. E. B., Lehighton, Pa., writes:

I have seen on some of the Pennsylvania coal cars that they have such large retainers. Do they hold more air pressure in the brake cylinder than the ones now in use, and is it a better retainer valve? Is it any advantage over the older one? A.—The form of retaining valve to which you refer is the special pressure retaining valve used on very heavy coal cars. There are two weighted valves in this retainer, one valve being of the usual shape, while the other valve is of the shape of an inverted cup, resting on the shoulders of the ordinary weighted valve. When the handle of the retainer is turned down, pointing toward the ground, both weights are out of commission and pressure from the brake cylinder escapes through the pipe and the valve freely to the atmosphere. When the handle is turned in a horizontal position, the outer, or inverted cup-shaped valve, is lifted by a heel on the handle from the shoulders of the ordinary weighted valve. This permits the ordinary weight to retain 25 lbs. pressure in the brake cylinder. With the handle in a half-way position, at an angle of 45 degrees, both the ordinary weight and the inverted cup weight oppose the escape of air through the retaining valve. These weights have a combined resistance of 50 lbs. and will hold that amount in the brake cylinder. The half-way position is only used on heavy loaded cars descending grades.

LATENT HEAT OF STEAM.

(57) J. W. S., Live Oak, Fla., writes:

Let us assume that the pressure in the boiler is 180 lbs., that is to say, every square inch of the sheet, top and bottom, receives an internal pressure of 180 lbs. If a thermometer be placed inside, it is found that the water and the steam are at the same temperature, 379 degs. F. But the steam contains more heat than the water, because after water is heated, more coal must be burned to break up the drops of water to change them into steam; this heat is stored in the steam and represents work done by the burning of the coal. If the steam and water are at the same temperature, why is there need to burn more coal to change the water into steam? It seems to me that if the water was as hot as steam, it would be turned into steam. But if steam is drawn from the boiler it will require more water and coal to maintain 180 lbs. of steam according to the amount of steam used. A.—This question involves a knowledge of what is known as the latent heat of steam. One pound of water at 212 degs. F., in passing from the liquid state at 212 degs. to that of steam at 212 degs., receives as much heat as would be sufficient to raise it through 965.7 degs. if the heat, instead of becoming latent had been sensible. Latent heat cannot be recorded by a thermometer, as sensible heat can. It is the change from the liquid to the gaseous state which absorbs so large a quantity of heat. It is this physical change which you speak of as "breaking up the drops of water to change them into steam" that takes heat and causes coal to be burned, but which does not raise the sensible temperature of the steam. Water at 212 degs. requires 965.7 British thermal units to turn it into steam at 212 degs., and this amount is spoken of as the latent heat of steam.

METHOD OF CHAINING UP CARS.

(58) I. M., Grand Rapids, Neb., asks:

Which is the better way to chain up a car with broken coupler? One way is to put the chain round the coupler of the car next ahead and through the link at the end of the chain and pass the grab-hook end round the center plate of the disabled car, draw up and secure with grab hook. This gives one chain between cars. The other way is to pass the chain round the center plate of the disabled car and also round coupler head, draw up and secure with grab hook. This gives two portions of chain between cars. A.—The second plan is easier to do and it is the stronger. The double chain might be crossed on itself in the form of the figure 8, so that in curving, the chains would have a better chance to accommodate themselves to the swing of the cars.

There are now 3,800,000 miles of telegraph wires in the world, along which 400,000,000 messages travel yearly.

Air Brake Department.

CONDUCTED BY F. M. NELLIS.

Air Brake Association Convention.

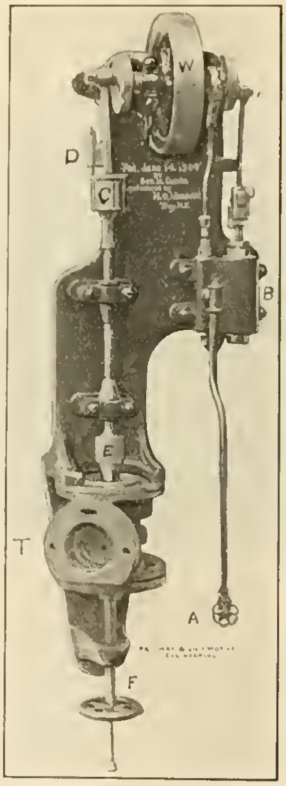
The twelfth annual convention of the Air Brake Association was held in New Orleans, beginning April 11 and continued for three days. President Hume, in his address to the convention, reviewed the progress of the Association's work for the past year, and called attention to the improvements in the air brake art during that period. He urged caution in convention statements, believing that only correct and reliable discussion should follow, as the proceedings of the air brake conventions are now being sought by high railroad officials, who accept the information contained therein to be of a thoroughly reliable nature. The secretary's and treasurer's reports showed the Association to be in its usual healthy financial condition. The membership had increased, and the Association appears to have before it a bright and successful future.

The first paper read was one on Automatic Oil Cups and Air Strainers for Air Pumps, by C. H. Larimer, Boston & Maine R. R. The consensus of opinion of those discussing the subject was that the old oiling device was inadequate and insufficient, and that automatic oil cups were necessary for oiling cylinders of air pumps on long, modern trains. A good air strainer was believed to be advantageous, and would materially reduce the wear of the air cylinder parts. The belief prevailed that the air strainer should be large in diameter, and be located so that it would not clog up with snow, ice and dirt.

A very interesting and important paper was read by Mr. G. R. Parker, Great Northern Ry., on the "Proportion of Brake Beam Levers." Mr. Parker showed the advantage of reducing the movement of the top end of the live lever, thereby preventing it from striking the truck frame, which it does with highly proportioned levers, when considerable brake shoe wear ensues.

A paper on "Train Pipe Leakage," by Mr. P. J. Langdon, Lackawanna R. R., and W. C. Hunter, Intercolonial Ry., and a topical subject paper presented by Mr. Robert Burgess, of the Westinghouse Co., were discussed in combination. Many of the bursted hose, break-in-twos, etc., was traced to low grade hose, and other hose not fully meeting the requirements of the Master Car Builders' specifications. A splendid object lesson was illustrated by the former paper, in which abnormal and uneven stretch of draft gear was shown to vary from 4 inches to 10 inches, when the slack was bunched and when it was stretched. These conditions, it was declared, were very difficult for the air brake hose to operate under, and especially in cold weather, when the hose is frozen and unyielding. Train pipe leakage is much greater during cold weather, due to a partial parting of the stiffly frozen hose.

Mr. L. M. Carlton, Chicago & Northwestern Ry., presented a very creditable paper on the "Design of Harmonious Hand and Air Brake Rigging." He illustrated a number of very bad designs, some of which are still the standards of certain railroads and some of which have been referred to the Master Car Builders' Association for criticism. The chief objections to the bad designs were that unequal pressure was exerted on the wheels of the two trucks when the hand brake was set, which doubtless accounts for the large number of slid flat wheels on coal and freight cars. The subject of faulty anchorage for hand brake staff was also illustrated and discussed.



CURRAN'S AIR MOTOR GRINDING MACHINE.

A paper on "Basing Braking Power on Unbraked Weight per Axle" was read by F. M. Nellis, Westinghouse Co. The paper aimed to relieve the lighter cars from undue burden and slid flat wheels, and to give a greater braking power to the heavier cars, which could afford to carry a greater amount of braking power.

The cleaning of triple valves and the use of lubricants was discussed as topical subjects, and brought out splendid information.

The election of officers resulted as follows:

President, L. M. Carlton; first vice-president, W. P. Garabrant; second vice-president, Geo. R. Parker; third vice-president, P. J. Langdon. Executive members, J. H. Hardy, J. R. Alexander and W. C. Hunter. Secretary, F. M. Nellis; treasurer, Otto Best.

Thus closed one of the most successful meetings of the Air Brake Association.

The selection of a meeting place for next year's convention will be decided by the Executive Committee later on. As indicated by an informal discussion of the subject, Montreal seemed to be the almost unanimous choice of the convention assembled.

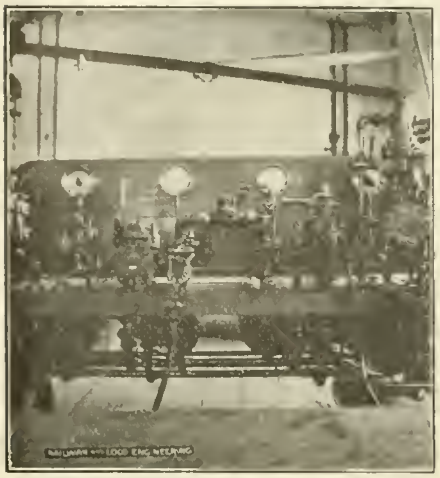
Air Motor Grinding Machine.

The accompanying photograph is from a machine for grinding triple valve piston packing rings in the bushings, in which they are to be used, and also triple slide valves, which will be of interest to air brake repair men and railroad companies.

The photograph shows the machine as being driven by a compressed air motor, but they are also built to be driven by belt. This is an ordinary slide valve engine in which the pressure is admitted at globe valve, A, and passes to air chest, thence to the cylinder, B, being governed by a slide valve. This slide valve is operated by an eccentric on the main shaft. As will be seen, the crank is driven by the ordinary piston and connecting rod.

On the opposite end of main shaft is a disk fitted with a slot in which can be adjusted the crank pin for reciprocating the main spindle, E, to which is attached the triple valve piston when grinding the rings. The throw of this crank can be varied to suit the work in hand.

The spindle, E, is furnished with a ball joint in the cup, C, and is rotated by the pawl, D, which is secured to the connecting rod, engaging in teeth in the upper edge of the cup, the motion of the pawl being given by the oscillation of the connecting rod, so that the rings



BRAKE VALVE TESTING RACK.

are revolved in the bushing while being ground.

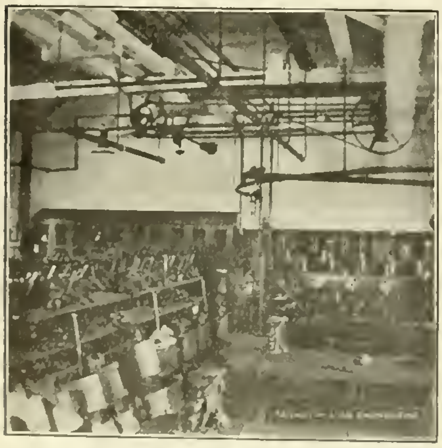
The bed of the machine has two projections, against which is forced the triple valve body by the screw F, and if this is put in place after the piston is in the chuck, everything is central and needs no further adjustment, as the projections are at right angles with the spindle.

The spindle is reciprocated between 400 and 500 strokes per minute, and usually five minutes' grinding with oil will show the rings to be well fitted to the bushing. We have had several of these machines in operation for the past year and very satisfactory results have been attained.

GEO. M. CURRAN,
N. Y., O. & W. Ry.
Middletown, N. Y.

The Air Brake Repair Department of the Chicago & Alton Ry. at Bloomington, Ill.

Lack of space prevents a thorough description of the Alton's air brake

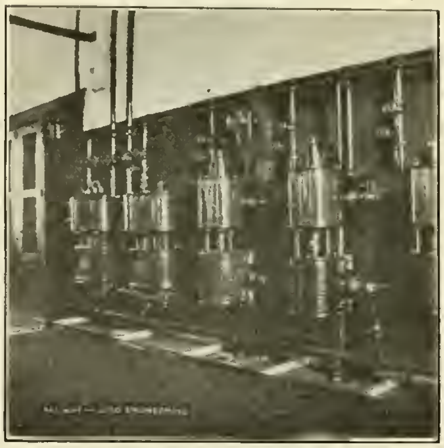


STORAGE RACKS FOR BRAKE VALVES, TRIPLES, ETC.

plant, that is, a description that would give due credit to the promoters of this recently installed department, Mr. C. E. Fuller, Supt. M. P. and Mr. G. J. Hatz, M. M. Nevertheless a partial description will perhaps show the benefits of a complete department as compared to the usual shop corner allowed for air brake repairs.

The exterior view of the building would not attract particular attention, resembling, as it does, any ordinary shop or manufacturing building, but it possesses extraordinary advantages for an air brake building. Its entire separation from the noise, dust and dirt of the main shop; its numerous windows and ventilator skylights, and its nearness to the tool room, machine shop and storehouse make it equal and surpassing many similar departments. The interior of the building is nicely whitewashed throughout the upper structure and on the side walls, excepting the rear wall, upon which are located the stores, lockers and pump testing rack in black and brown colors.

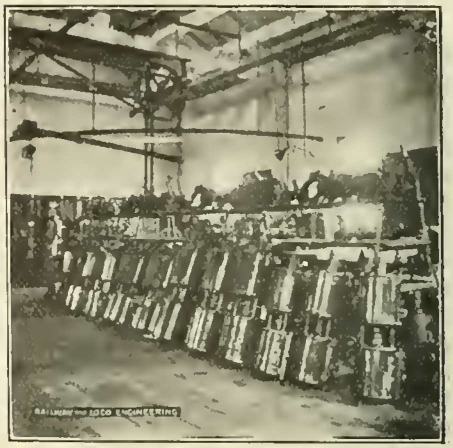
The heating arrangement is nicely



AIR PUMP TESTING RACK.

gotten up. It is so piped that either exhaust or live steam can be used for this purpose. During working hours the exhaust steam is used, which is obtained from the pumps undergoing tests. Suitable clothes lockers have been located in pairs at equal intervals along the walls, causing a notable absence of old hats and coats and overalls strewn about. The storage racks for material repaired and awaiting repairs are very neat in construction, being composed of a supporting structure of 1-in. pipe with shelves thereon. One of these racks is used for storing pumps, engineers' valves, triple valves, governors, signal apparatus, etc., etc.; the other for injectors, lubricators, electric headlights and bell ringers. These racks are open on all sides, allowing no hiding place for an accumulation of dirt, waste or repair parts.

Commencing upon the right as entering, there is a hose stripping and mounting machine, back of which is a hose storage rack built of 1-in. pipe, reaching upwards to the eaves. Ad-



STORAGE OF REPAIRED AIR PUMPS.

jacent to this hose machine is a work bench, where angle and cut-out cocks are reground. An air pipe with suitable valves for testing these cocks is close by. Immediately back of this bench is another, where engineers' valves, triple valves and high-speed equipment are repaired, and next to this bench is a very nicely arranged and compact testing table, upon which these above mentioned valves are tested, in addition to the governors, steam heat regulators, signal apparatus and the minor smaller valves. Back of this table are the pump repair stands. These stands resemble in their workings the many which have the revolving and angular features, making it possible for the repair man to have any part of pump on the upper side and handy to get at. At the right of these racks are two lye vats of ample proportions to take four or five complete pumps, with many smaller articles. On the rear wall is the pump testing rack, having space and attachments for two each of 8 ins. and 9½ ins. and No. 2 N. Y. pumps.

At the left of this testing rack are

TRIPLE VALVE STORAGE RACK.

the material storage lockers, ten in number, containing all the smaller repair parts for injectors, lubricators and air brakes. There are three work benches on the left side of room and a permanent headlight dynamo for testing headlight lamps. At the left of the entrance a corner has been allotted to the electricians for their repair work. In the upper structure there is a motor and driven shaft, use of which is being contemplated for operating suitable machinery for air brake repairs. There are many little conveniences, not mentioned here, all of which assist in the object of the improved plant, that of increasing production and decreasing amount of material supplies, both of which have been accomplished to an amount remarkable.

E. O. Palmer.

Bloomington, Ill.

Air Pump Swab.

Many of your readers have, no doubt, seen an air pump swab resembling this one illustrated in the accompanying sketch, but for the information of the many who are having difficulties in keeping this very necessary adjunct to an air pump, upon the pumps, will give a short description of the same.

The inner, or foundation band, is of 1/16 sheet lead, although any pliable metal will answer the purpose. It is ¾ in. wide and 6 ins. long. Ordinary wicking is wrapped around this lead, once lengthwise, and three times crossways. The outer, or retaining band, is of thin sheet copper, ¾ in. wide and 8½ ins. long, bent and riveted at one end to hold 1/16-in. wire loop, the opposite end of the band being passed through this loop and bent back, holding the swab proper securely clamped to the piston rod.

Six to ten months' service will be gotten out of these swabs before necessary to renew the wick winding. The metal parts, being practically indestructible, can be used many times; however, the copper band should be annealed each time that the swab is repaired, to prevent breaking off of the plain end.

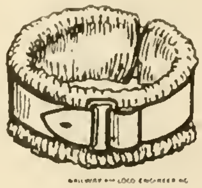
E. O. Palmer.

Bloomington, Ill.

Lubricator Filling Plug.

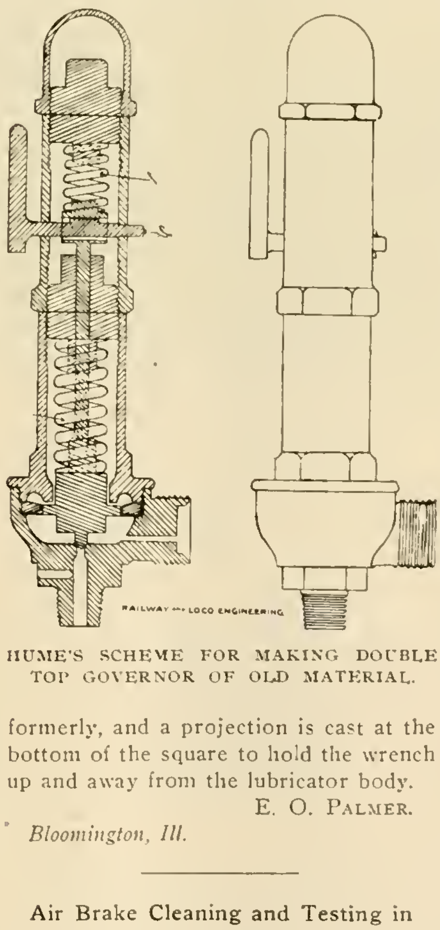
Inasmuch as the lubricator manufacturers have never constructed a filling plug to remedy the defect, and that I have never seen or learned of one in which the form was changed to resemble that in attached sketch, I am crediting myself with being the originator of the improvement, criticism on which will be received cheerfully.

Lubricator repair men have all noticed that the front condenser pipes of the Detroit Lubricators are nearly always dented in or bent, and many times the attaching plug in body of lubricator is broken off by a wrench in the hands of the engineer when loosening the plug. The Detroit Bullseye Lubricator, after having been in service a short time, will show a worn spot on condenser which wear might continue through wall in time. With the old style Nathan, the oil glass cap in upper bracket is generally worn off on one corner from the



PALMER'S PISTON ROD SWAB.

same cause, necessitating the use of an alligator wrench to remove it, and I have seen instances where the bracket was loosened to a leaking point, in one instance the bracket being broken off entirely by a sudden movement of the wrench. I have found this style of plug an improvement over the old one in all locomotive cylinder lubricators. You will observe that the only difference is that the square is moved up to the top end instead of being in the center as



HUME'S SCHEME FOR MAKING DOUBLE TOP GOVERNOR OF OLD MATERIAL.

formerly, and a projection is cast at the bottom of the square to hold the wrench up and away from the lubricator body.

E. O. Palmer.

Bloomington, Ill.

Air Brake Cleaning and Testing in Texas.

The road with which I am connected is one of the first in this part of Texas to adopt the Westinghouse triple valve testing appliances. At present we have at our main terminals six of these testing plants in operation, each of which have from two to three men cleaning cylinders and removing triple valves and testing same, one man being assigned to clean and test the triple valves.

Our best rack men clean and test from ten to twelve triple valves a day. They do all the repairs found to be necessary on these triples, except to replace defective packing rings or renew bushings that are badly worn. Triple valves found with these defects are shipped to the American Brake Co., at St. Louis, where the Westinghouse Air Brake Co. has a plant fitted up for repairing triple valves.

In going over our triple valves the first time on the test plant, we found most of our passenger triple valves with badly worn bushings which would not pass the controlling valve test. We also found several freight triples in same condition. Since then we have been through them all and don't find any more high leakers, and it also has reduced our slid flat wheels.

Our triple cleaning report for the year ending December 31, 1904, was 11,404 triple valves removed, cleaned, oiled and tested, of which 1,400 were foreign cars. We give the foreign triple valves the same attention we do our own, charging the owners M. C. B. prices for all repairs made on them.

Each triple valve is stenciled with white lead, with a letter representing station where the valve is tested, so it will be easy to locate where the triple was tested, stencil station, and date of last cleaning on cylinders. Since we have been making the rigid triple valve test, we have no more complaint sent in of triples going into quick action and breaking trains apart. We are cleaning our passenger triple valves three times a year, and are going to try and clean our freight triples twice.

We have all our passenger cars equipped with automatic slack adjusters from which we are getting good results. They are cleaned and tested each time the brake apparatus is cleaned.

H. T. Hunt,

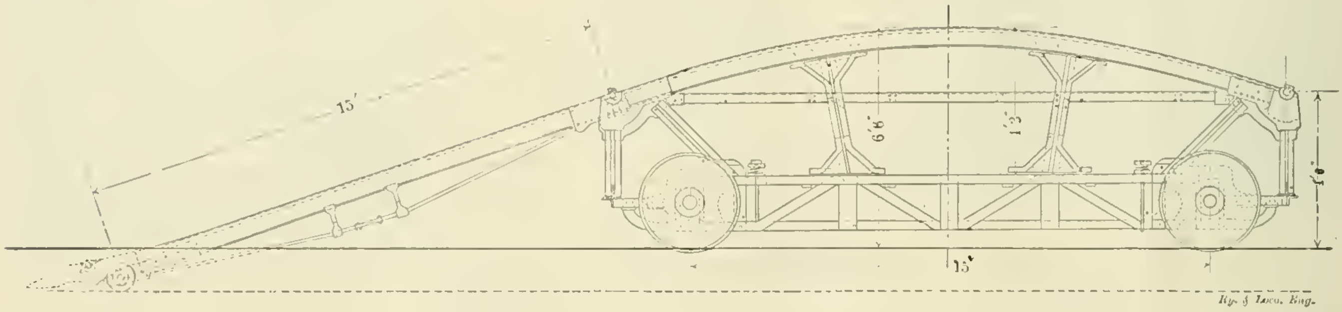
Trav. A. B. Insp., Texas & Pacific R. R.,

Marshall, Tex.

Crane Co. have just issued their Advance Circular, describing Crane steam and oil separators, for the separation of water from live steam, and the elimination of oil from exhaust steam. These separators are made in sizes from 1 to 30 inches, and in horizontal, vertical, angle and distributing types. The circular contains 26 sheets, measuring 10½ x 13½ ins.; it is printed on white enameled paper, and handsomely illustrated with half-tone engravings. It will be sent to the trade upon request. When writing, ask for the "Advance Circular No. 01." Crane Company, Chicago.

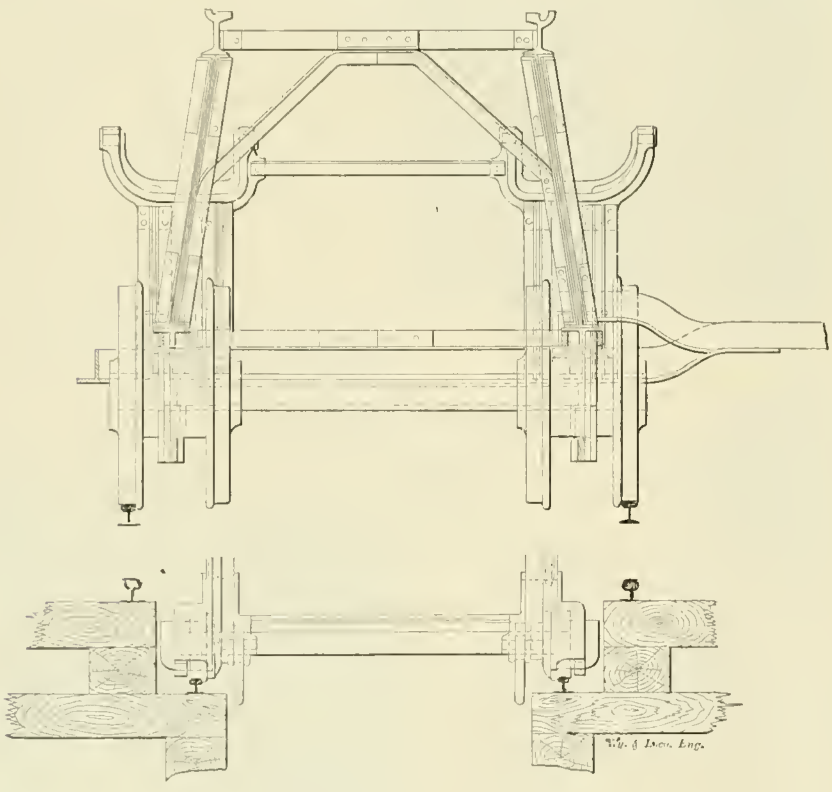
Collision Avoider.

A great many railroads, both steam and electric, have from time to time tried to have trains or cars going in opposite directions pass one another on a single track, but they have always made a dead failure of it, yet to show that the idea has not been entirely given up, we illustrate the general arrangement of a pair of cars which were built for use on a gravity railway at a popular pleasure resort.



COLLISION AVOIDER OR LEAP FROG CAR.

These cars are intended to be collision avoiders, because when they meet at full speed on a single track, one of them runs up over the back of the other, and down onto the rails on the other side, just like a kitten might run over the back of the old cat to avoid being caught.



SECTION OF LEAP FROG CAR.

Considering one of them we may say the car runs on a track made of 60 lb. rails, with a gauge measurement of about 6 ft., and it is carried on four wheels, these having a spread of 15 ft. The frame is practically a light open lattice truss with axle boxes, sliding and jaws, at the ends of the frame bars. The frames are tied together by diagonal and straight braces.

On the top of the truck frame is carried a sort of bridge structure of the bow-string girder type. This structure is cross braced and is carried on substantial built up posts placed raidially as far as the top chord is concerned. On the top of all, two girder rails, such as are used for street car lines, are placed, having a gauge of about 4 ft.

At either end of the car these girder street car rails, stiffened by a pair of truss rods, slope to the grouna, each being 15 ft. long. The lower ends of these rails have a small pair of wheels which run upon a pair of light 30 lb. rails, and this subsidiary track is placed about 14 ins. below the regular track rails and has a gauge of 4 ft. 6 ins. The little wheels at the ends of the sloping track are off-set so as to preserve the sloping track at the 4 ft. gauge, which is the same as that over the top of the car. The sloping rails are tied together with pin connections.

This whole arrangement, therefore, shows a car moving along over a 6 ft. track and carrying a 4 ft. track, the lower ends of the inclined rails at each end going below the level of the main rails. The pivot points for the sloping rails at the car ends are 4 ft. 6 ins. high and the grade which the colliding car has to encounter is over 1 in 3, or about 33 per cent. The highest point of the track on the turtle back of the car is 6 ft. 4 ins.

The anti-collision idea is carried out by the fact that each car is equipped with four wheels on each axle. Two are set for the 6 ft. track and two for the 4 ft. track. Only one car is equipped at both ends with the sloping rails or scoop track, as we may call them. Both cars are built so that by the application or removal of the sloping rail at each end either car may become the scooper and the other the scoopee, as occasion demands.

The passengers are carried on seats on the steel outriggers which project from the sides of the car. The way the cars meet and avoid a damaging collision may be described as follows: The scooper, or the car with the inclined track fore and aft, starts on its way rejoicing, looking like a pointer with nose down, following the scent, and with tail also down, which is not particularly dog like. This car runs on the 6 ft. track and continues to do so all the trip, while its 4 ft. gauge wheels turn round freely without touching anything.

The scoopee, or car without inclined rails, starts off from its end of gravity road and runs at the scooper with malice prepense, it also moving on the 6 ft. track. When the cars are about to meet with a crash, the inclined rails at the front of scooper advance under the scoopee and catch the flanges of its 4 ft. gauge wheels in flange ways of the scoop track and up the scoopee goes, its 6 ft. gauge wheels turning idly in the air. When it reaches the highest point it simply slides down off the scooper like water off a duck's back; its 6 ft. gauge wheels striking the 6 ft. track, begin doing business while the 4 ft. gauge wheels, which carried it over now turn idly as before. These cars have actually been built, but have not yet gone into commission.

Floating Locomotive Water Filter.

Butternut creek water is not good for locomotives, and that is why the New York Central have installed a novel water filter at East Syracuse. The water from this steam contains a good deal of lime and magnesia, and with a view of removing this incrusting material the company have installed a filter 24 x 38 ft. in size.

The curious thing about the filter is that it floats. Its bed is made of sand and prepared carbon, and the water which is used by the locomotives passes upward through the layers of which it is composed. The action of the filter is said to be that the lime and magnesia are precipitated and the water is oxydized and even the bacteria are destroyed. The filter is automatic in its action, and the water which percolates through and which is drawn off is always of the same degree of purity. The filter is automatic because as fast as water is drawn off from the top an equal amount passes up to the top and is purified in the process. The filter, while it floats, is anchored, so that it does not alter its position, and the whole arrangement works very satisfactorily.

Moving Roadway.

The city of Cleveland, Ohio, has a moving roadway which is worked something on the principle of the escalator. There is a great deal of heavy vehicle traffic on Factory street, and the grade of the road is over 15 per cent. Heavily loaded wagons sometimes take half an hour to get up it and generally extra horses have to be provided in order to get up at all.

The moving road is 420 ft. long and consists of 8 ft. planks stiffened with angle irons. Each succeeding pair of planks is bound together, and each pair so united are connected together with heavy links, and thus a continuous roadway like an endless chain is made. The whole road runs on four thousand small wheels of the Hyatt roller bearing type. Two large sheaves or pulleys at either end give motion to the roadway as they revolve. The underneath returning portion of this roadway belt, as we may call it, is carried on idle wheels. The weight of the road itself is 106 tons. It is carried on substantial bearings so that it does not itself sag and is not affected by the presence of loaded vehicles on it. An inclined plane leads down to this road and it travels itself on an upward incline so that it makes a total rise of 65 ft.

The power used is electricity and comes from one of the lighting plants of the city. The movement of the road is controlled by an operator stationed in a sort of little sentry box at the head of the incline. The way it is operated is this: When a loaded wagon is driven on the entering platform the road is stopped by the operator, the team is then driven on the road and the roadway started while horses and load remain at rest. The wheels of the cart are blocked, so that when the rise begins there will be no "backsliding." When about twenty or thirty feet have been traversed another team may be admitted and so on all the time. At the top the wagons may be driven off without stopping the moving road.

Baldwin Balanced Atlantic.

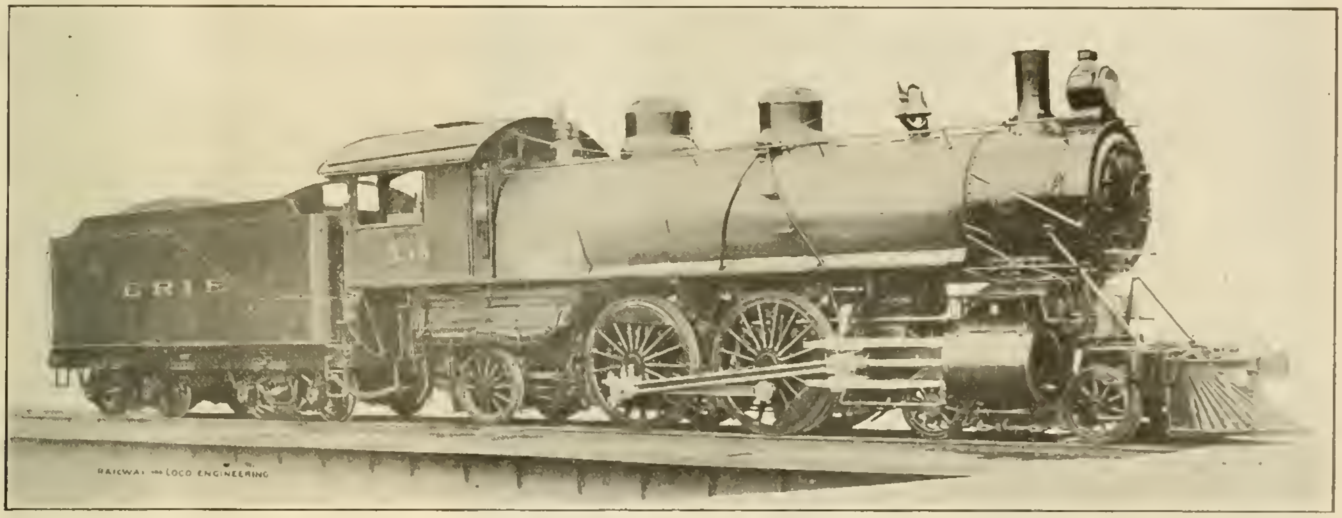
Our illustration is of a Baldwin balanced 4-4-2 compound, built for the Erie Railroad. This type is steadily pushing its way into favor on American railroads, and it is safe to say it will become more and more popular in proportion as its many good features become known.

The engine is a four-cylinder compound, with cylinders 16 and 27x26 ins. It has 72 in. driving wheels. The low pressure cylinders are outside and their pistons drive on the crank pins of the rear pair. The high pressure pistons drive on the crank axle, which is axle of the front pair. In this engine one canot correctly speak of one pair being main drivers, because both pair of wheels are turned by separate sets of pistons in separate cylinders.

The cylinders and piston valves are all contained in a pair of castings which fits below the smoke box. In this particular the engine is different from the Cole four-cylinder compound for the N. Y. C., which was illustrated in the June, 1904, issue of RAILWAY AND LOCOMOTIVE ENGINEERING, page 272. The Cole compound has the high pressure cylinders ahead of the low pressure. In fact they are carried between the frames, where the front footplate is usually placed.

The high and low pressure cylinders of this Erie engine are all placed in a horizontal position, and the center of each is on the same horizontal line, and the centers of all the cylinders are on horizontal line joining the driving axles. It will be noticed that the engine, as shown in our half-tone, is standing with crank pins on the bottom quarter, yet the low pressure crosshead is much nearer one end of the guide bars than the other. This is due to the fact that the low pressure piston rod is purposely made too long to all go into the cylinder, and this arrangement allows the driving wheels to be placed far enough back to give a good length of connecting rod both for the high as well as for the low pressure cylinders.

The main valves are of the balanced

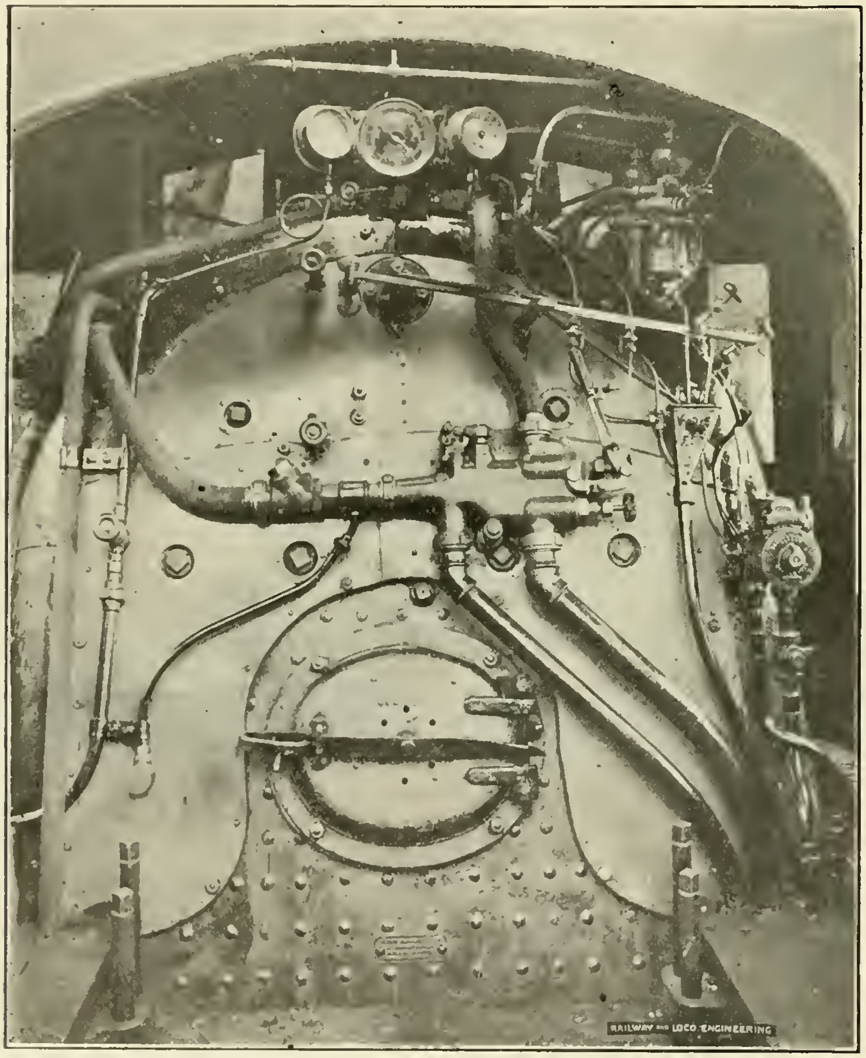


George W. Wildin, Mechanical Superintendent. FAST PASSENGER 4-4-2 FOR THE ERIE. Baldwin Locomotive Works, Builders.

piston type, of 15 ins. diameter, or one inch less than the high pressure cylinder. The eccentrics are placed on the axle of the rear drivers, and these give movement to the valves through indirect motion. The driving wheels and the carrying wheels under the cab are all equalized together. The position of the counterbalance weights on both pair of drivers is worth noticing, as the presence of a crank axle makes a departure from regular practice necessary.

The boiler of this engine is of large proportions, being 68 ins. diameter at the smoke box end. The fire box is wide, extending beyond the frames. It is 108⅛ ins. long and 72 ins. wide, and this gives a grate area of 54 sq. ft. A steam pressure of 225 lbs. is carried. The crown sheet is radially stayed and is horizontal. The back sheet and fire box back sheet slope forward from the mud ring up. The tubes are 309 in number; they are 2¼ ins. in diameter and are 19 ft. long. The heating surface derived from them is 3,442.8 sq. ft., the fire box gives 186.2 and the tubes for the fire brick arch gives 28, so that the total amounts to 3,657 sq. ft. This is very nearly the area which would be swept over by revolving a 68¼-ft. turntable once round.

The tender is one of the regular Erie pattern, having water bottom and fore and aft bulkheads in the coal space. The tank holds 8,500 U. S. gallons of water, and 12 tons of coal can be carried. The tender frame is steel. The engine is a very powerful machine, and has been designed with a view of hauling heavy passenger trains over the road and on time. The tractive effort of the engine is about 33,600 lbs. A few of the principal dimensions are given below:



INTERIOR OF CAB OF ERIE FOUR-CYLINDER COMPOUND. EVERYTHING WITHIN EASY REACH OF THE ENGINEER.

Boiler—Thickness of sheets, 11/16 in. and ¾ in. Fuel, soft coal.

Fire Box—Material, steel; depth front, 71½ ins.; back, 69 ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube ½ in.

Water Space—Front, sides and back, 4 ins.

Tubes—Material, iron; wire gauge, No. 12.

Driving Wheels—Journals, front, 10 x 10½ ins.; back, 9 x 12 ins.

Engine Truck Wheels—Front, diameter, 33½ ins.; journals, 6 x 12 ins.

Trailing Wheels—Diameter, 44 ins.; journals, 8½ x 12 ins.

Wheel Base—Driving, 7 ft.; rigid, 16 ft.; total engine, 30 ft. 1 in.; total engine and tender, 59 ft. 10 ins.

Weight—On driving wheels, 115,500 lbs.; on truck, front, 47,500 lbs.; on trailing wheels, 41,200 lbs.; total engine, 204,200 lbs.; total engine and tender, about 356,000 lbs.

Tender—Wheels, diameter, 33½ ins.; journals, 5½ x 10 ins.

Universities Get Old-Timers.

The University of Michigan has secured an old time locomotive, which is more than seventy years old. It was one of the first used on the Boston & Providence Railroad, and after it was withdrawn from active service it was stored in the roundhouse at Plainfield, Mass., where it was, to use a bible phrase, hiding its light under a bushel, as far as the general public was concerned.

Another old timer which has likewise been hiding its light, comes from the New York, New Haven & Hartford, and is to be loaned to Perdue University, at Lafayette, Ind. This institution has a museum for old locomotives, and thus seeks to preserve types and designs which threaten to become extinct.

This engine was called the "Daniel Mason," and was built in 1858. It is of a type largely used in New England many years ago. It has inside cylinders and a crank axle. Purdue is also to have an old passenger car from the same railroad said to have been put in service in 1835 and which has seating capacity for 20 persons. These university museums are the proper place for our early engines and cars. In these institutions they can be easily got at and studied by those interested in the early history of railroading.

The Baltimore & Ohio Railroad are making extensive improvements in connection with the supply of water for use in their locomotives. President Murray has recently authorized improvements on the line of the system between Connellsville and Pittsburg, which includes the establishing of water treating plants at Emblem and Glenwood to eliminate the acids, etc., from the river waters used. This work will cost in the neighborhood of $150,000.

The recent annual droughts in this district have resulted in the river waters becoming badly contaminated and polluted by the refuse from mines, mills and decaying of animal and vegetable matter, and this has resulted not only in the scarcity of supply but in a water that is entirely unfit for locomotive purposes, and the consequence has been great expense and delay in the handling and maintenance of power, and in the movement of traffic.

Of Personal Interest.

Mr. Charles Hall has been appointed traveling coal inspector on the Erie Railroad.

Mr. C. L. Crowe has been appointed night yardmaster on the Interstate Railroad at Stonega, Va.

Mr. Max T. Price has been appointed assistant superintendent of the Interstate Railroad, with office at Stonega, Va.

Mr. E. H. Chapman has been appointed master mechanic of the Interstate Railroad, with headquarters at Stonega, Va.

Mr. T. P. Shonts, chairman of the Isthmian Canal Commission, has been elected president of the Panama Railroad.

Mr. J. M. Walsh has been appointed superintendent of the Joplin Division of the Missouri Pacific, with office at Nevada, Mo.

Mr. R. G. Hengst has been appointed assistant chief engineer of the Western Allegheny Railroad, with office at New Castle, Pa.

Mr. H. W. McMaster has been appointed superintendent of the Wheeling & Lake Erie Railroad, with headquarters at Canton, Ohio.

Mr. Webb C. Ball has been appointed general time inspector on the Toledo, St. Louis & Western, with headquarters at Cleveland, Ohio.

Mr. O. H. Hobbs has been appointed superintendent of the Connellsville Division of the Baltimore & Ohio, vice Mr. J. F. Irwin, transferred.

Mr. J. F. Irwin has been appointed superintendent of the Newark Division of the Baltimore & Ohio, vice Mr. F. C. Batchelder, transferred.

Mr. N. K. Hoffman has been appointed superintendent of car service on the Wheeling & Lake Erie Railroad. This is a newly created office.

Mr. G. A. Gallagher has been appointed master mechanic on the Illinois Central, with office at Sparta, Ill., vice Mr. R. J. Farrell, resigned.

Mr. F. C. Batchelder has been appointed superintendent of the Chicago Division of the Baltimore & Ohio, vice Mr. J. A. Spielmann, transferred.

Mr. W. S. Murray has been appointed electrical engineer of the New York, New Haven & Hartford Railroad, with headquarters at New Haven, Conn.

Mr. J. F. Wallace, chief engineer of the Isthmian Canal Commission, has been elected vice-president and general manager of the Panama Railroad.

Mr. J. B. Gannon has been appointed master mechanic on the New York, New Haven & Hartford, with headquarters at New London, Conn.

Mr. H. W. Bethel has been appointed traveling engineer of the Gulf & Ship Island Railroad, including the Columbia, Laurel and Silver branches of that road.

Mr. Fred Kerby has been appointed air brake instructor and inspector of the main line system of the Baltimore & Ohio, with headquarters at Baltimore, Md.

Mr. W. J. Hoskins, formerly foreman of locomtive repairs on the C., B. & Q., has been appointed master mechanic on the Chicago & Eastern Illinois at Danville, Ill.

Mr. R. F. Whalen, Jr., has been appointed foreman of locomotive repairs at Hannibal, Mo., on the Chicago, Burlington & Quincy, vice Mr. W. J. Hoskins resigned.

Mr. Carl M. Gage, general manager of the Huntington & Broad Top Mountain Railroad, has been elected vice-president of the same road, vice Mr. S. Bancroft, Jr., promoted.

Mr. E. F. Kearney has been appointed superintendent of terminals with jurisdiction over train, yard and station service at St. Louis, Mo., on the Missouri Pacific Railway.

Mr. J. W. Gay, of Oscala, Fla., has been appointed machinist of the High Springs roundhouse of the Atlantic Coast Line Railway, vice Mr. J. W. Swain, promoted.

Mr. George Akans, roundhouse foreman at Birmingham, Ala., on the Southern Railway, has been appointed general foreman at Greensboro, N. C.

Mr. Samuel Bancroft, Jr., vice-president of the Huntington & Broad Top Mountain Railroad, has been elected president of the same company, vice G. H. Colket, deceased.

Mr. J. T. Brady, heretofore master mechanic on the New York, New Haven & Hartford at Norwood, has been transferred in the same capacity to New Haven, Conn., on the same road.

Mr. Frank Kingsley, formerly with the Chicago Great Western Railway, has been appointed general foreman of the Northern Pacific shops at Helena, Mont., vice H. G. Mumm, resigned.

Mr. C. M. Weathers has been appointed road foreman of engines for the first division of the Atlantic Coast Line Railway. Mr. Weathers has been hard at it for several months with good results.

Mr. Orville H. Reynolds, formerly on the staff of the *Railway Review* of Chicago, has accepted the position of editor of the *Railway Master Mechanic*. Mr. Reynolds' office will remain in New York.

Mr. Frederick E. Owen has been appointed traveling engineer of the Dakota Division of the Great Northern Railway Line, with headquarters at Larimore, N. D., vice Mr. A. B. Ford, transferred.

Mr. H. B. Palmer, superintendent of the Rocky Mountain Division of the Northern Pacific Railway, has been appointed assistant general superintendent at Tacoma, vice Mr. A. E. Law, resigned.

Mr. C. J. Stewart has been appointed master mechanic of the Central New England Railway, with office at Hartford, Conn., vice Mr. J. B. Gannon, resigned to accept position with another company.

Mr. John H. Fulmor, inspector in the West Philadelphia shops of the Pennsylvania, has been appointed master mechanic of the Schuylkill Division of the same road, with headquarters at Mt. Carbon, Pa.

Mr. E. D. Andrews, formerly road foreman of equipment on the C., R. I & P. at Shawnee, Okla., has been appointed master mechanic of the El Passo Division of the same road, with office at Dalhart, Tex.

Mr. F. N. Norman, formerly foreman of the Seth Watkins Machine Company, of Hattiesburg, Miss., has been appointed engine house foreman on the Illinois Central, at Harrihan, La., vice Mr. R. Elezy, resigned.

Mr. J. F. Sheahan, master mechanic at Spencer, N. C., on the Southern Railway, has been transferred to the Atlantic Division as master mechanic, with headquarters at Atlanta, Ga., vice Mr. S. M. Dolan, resigned.

Mr. J. W. Swain has been promoted to the position of locomotive foreman at Dunnelton, on the Atlantic Coast Line Railway. Mr. Swain was formerly machinist at the High Springs roundhouse on the same road.

Mr. J. M. Rapelje, heretofore trainmaster of the Yellowstone Division of the Northern Pacific Railway, has been appointed superintendent of the same division, at Glendive, Mont., vice Mr. A. Gibson, transferred.

Mr. J. M. Ashley has been appointed road foreman of engines of the new division of the Seaboard Air Line Railway, with headquarters at Atlanta, Ga. His jurisdiction extends from Birmingham, Ala., to Atlanta, Ga.

Mr. James Hocking, master mechanic on the New York, New Haven & Hartford at New Haven, has been transferred to Norwood, Conn., as master mechanic on the same road. He has been enjoying a trip to the old country.

Mr. A. J. Prole, formerly master mechanic of the fourth and fifth divisions of the Seaboard Air Line, at Savannah, Ga., has been transferred as master mechanic to the third division of the same road, with office at Atlanta, Ga.

Mr. E. C. Sasset has been appointed shop superintendent of the new shops at Spencer, N. C., on the Southern Railway. He was formerly general foreman of the Richmond, Va., shops of the American Locomotive Company.

Mr. Andrew Gibson, superintendent of the Yellowstone Division of the Northern Pacific Railway, has been transferred as superintendent of the Rocky Mountain Division of the same road, with office at Missoula, Mont., vice Mr. H. B. Palmer, promoted.

Mr. N. F. Kaderly, general foreman at Greensboro, N. C., on the Southern Railway, has been appointed master mechanic of the Washington Division, with headquarters at Alexander, Va. Mr. Kaderly served his time in the Knoxville, Tenn., shops.

The Tabor Manufacturing Company, of Philadelphia, announce that Mr. E. H. Mumford, formerly their secretary and treasurer, has severed his connection with them. All business communications for that concern should now be addressed direct to the company.

Mr. A. E. Woodbury, formerly employed on the Mohawk & Malone Railroad, has been appointed shop inspector of the American Locomotive Company's Works in Montreal. Mr. Woodbury was formerly an engine despatcher on the Mohawk & Malone road.

Mr. R. E. McCarty has been appointed general superintendent of the Pittsburgh, Cincinnati, Chicago & St. Louis Railroad, including the southwest system of the Pennsylvania lines west of Pittsburgh, with office at Columbus, Ohio, vice Mr. Ralph Peters, elected president of the Long Island Railroad.

Messrs. E. H. Mumford and C. S. Lovel have recently formed the E. H. Mumford Company for the purpose of manufacturing molding machinery of all descriptions. The office of the new company is on the corner of 17th and Callowhill streets, Philadelphia. These gentlemen were formerly with the Tabor Mfg. Co.

Mr. B. H. Gray, general foreman of the engine and car department of the Illinois Central at New Orleans, La., has resigned his position to become master mechanic on the 'Frisco System, with headquarters at New Orleans, La. Mr. Gray has the reputation of being a very progressive and able mechanic, and we predict a bright future for him.

Mr. Frederick A. Delano, formerly general manager of the Chicago, Burlington & Quincy, has been elected president of the Wabash, Pittsburgh Terminal Railway and West Side Belt Railway, vice Mr. Joseph Ramsey, Jr., resigned. Mr. Delano's office is in St. Louis, Mo. He is a mechanical department man now occupying a president's chair.

Mr. W. S. Murrian, master mechanic at Alexandria, Va., on the Wash'ngton Division of the Southern Railway, has been transferred as master mechanic to the Danville-Charlotte and Ashville Divisions, with headquarters at Spencer, N. C. New shops have just been completed at this point, with capacity for heavy repairs for 30 engines per month. Mr. Murrian has charge of this new repair plant.

Mr. L. Kays has resigned his position as road foreman of engines on the New York, Susquehanna & Western, and has accepted a more lucrative position with the Delaware & Hudson Canal Company, at Wilkes-Barre, Pa. On leaving the N. Y., S. & W., Mr. Kays was presented with a watch charm by the engineers and firemen of the road as a token of the high regard they entertained for him.

Mr. Ralph Peters has been elected to the position of president of the Long Island Railroad, which was vacated by the death of W. F. Potter. Mr. Peters graduated from the University of Georgia in August, 1872. He entered railway service the same year, and since then he has been, consecutively to August, 1874, superintendent Atlanta Street Railroad at Atlanta, Ga. From August, 1874, to February 1, 1881, he held the posts of secretary and chief clerk to the general superintendent of the Pittsburgh, Cincinnati & St. Louis Railway. From February, 1881, to June, 1881, he was superintendent of the western division, Columbus, Chicago & Indiana, Central Division of the Pittsburgh, Cincinnati & St. Louis Railway, and from June, 1881, to June, 1901, he was superintendent Little Miami Division of the same road; superintendent Newport & Cincinnati Bridge Company; also October, 1885, to October, 1888, vice-president of the Cincinnati, Georgetown & Portsmouth Railroad; October, 1888, to the present time, president of same road; January, 15, 1896, June, 1901, also general agent Pittsburgh, Cincinnati, Chicago & St. Louis Railway at Cincinnati, Ohio; also superintendent of the Cincinnati, Lebanon & Northern Railway. He was from June 1, 1901, to present time general superintendent of the southwest system of the Pennsylvania l'nes west of Pittsburgh the Pittsburgh, Cincinnati, Chicago & St. Louis Railway; also of the Cincinnati & Muskingum Valley Railroad, and the Cincinnati, Lebanon & Northern Railway Co., which are branches of the Pennsylvania lines. Mr. Peters now has his office at Long Island City, New York.

Obituary.

HENRY C. MAHANNA.

One of the veteran old time railway officers has just passed away when, on April 3, Henry C. Mahanna died of heart failure. Mr. Mahanna, formerly super-

H. C. MAHANNA.

intendent of the Eastern district of the Nebraska & Wyoming divisions of the Chicago & North-Western Railway, had served the company in various places and positions for thirty-seven years. Like the majority of our successful railroad officials, he began at the bottom of the ladder and worked up by slow degrees, every step bringing the intimate acquaintance with details that no other course of learning railroad business can impart. He began as a brakeman and rose through the steps of conductor, station agent, train master, assistant superintendent and superintendent. Mr. Mahanna was a highly efficient and popular railway superintendent, a good man for the interests of his employers, and one whom his subordinates regarded more in the light of a friend than a master.

WILLIAM FREDERICK POTTER.

In our February issue we made mention of the appointment of William F. Potter to the post of president of the Long Island Railroad, and we have now the sad duty of recording the untimely death of that most energetic and efficient railroad officer. He was born October 26, 1855, at Utica, N. Y., and was educated at Highland Military Academy, Worcester, Mass., and on October 1, 1873, he entered the employ of the Flint & Père Marquette Railroad as a clerk in the auditor's office; from October 31, 1876, to September, 1877, he was a clerk in the treasurer's office of that road. From September, 1877, to November 1, 1879, he was a conductor on a passenger train of the Marquette road. He was then promoted to be station master at East Saginaw, Mich., which post he held to June, 1881. From that time on to July 5, 1884, he held the position of superintendent of the Eastern Division of the road. Then he was promoted to assistant general superintendent, which place he held until August 10, 1891, when he became general superintendent. On January 1, 1897, Mr. Potter was promoted to be general superintendent of the Long Island Railroad. He was soon advanced to vice-president, and at the death of Mr. Baldwin he became president of the road. One of President Potter's latest projects was the improvement of ferry service between Manhattan and Long Island City, which project he hoped to accomplish before summer. In 1880 Mr. Potter married Miss Jeannie V. Stetson, a daughter of a prominent merchant of Hartford, Conn.

Erie's Supreme Express Engine.

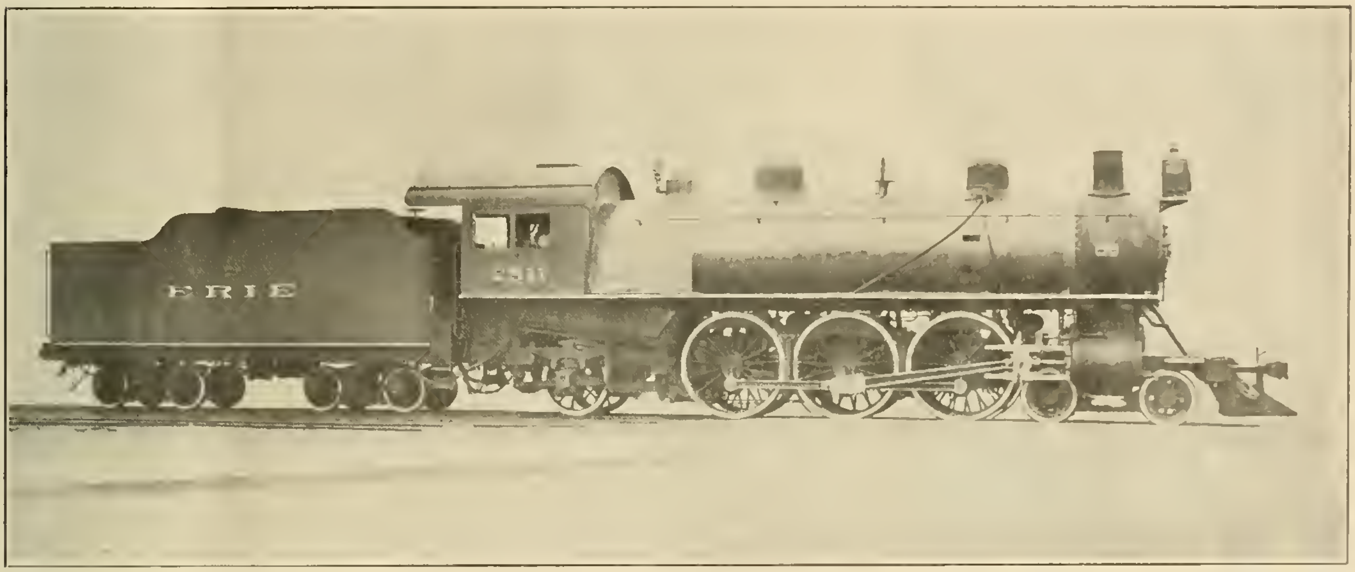
In describing in our March number the run of a very powerful locomotive pulling an express train on the Erie Railroad, we expressed a doubt that an engine could be built under certain restrictions that would haul a train of 500 tons over the Eastern Division of the Erie, a distance of 89 miles in 130 minutes. A free confession is good for the soul, and we are free to confess that we were mistaken, for, on April 25, the Erie Railroad people made a test of an engine designed by their own officials, which not only did the work with a heavier load, but did it with 7 minutes to spare.

A difficult problem which the Erie management has been trying to solve is the running of their heavily loaded No. 5 express train from Jersey City to Port Jervis, 89 miles in 130 minutes, making three stops on the way. The division is very difficult to operate, having long, steep grades, one stretch of 35 miles rising 46 ft. to the mile, with numerous sharp curves, that make the train resistance very trying on motive power. Various attempts were made to meet the required performance, a run made in February last with a San Pedro, Los Angeles & Salt Lake Railroad engine having been the most ambitious. This engine, of the 4-6-2 type, had cylinders 22x28 ins., driving wheels 77 ins. diameter, 141,000 lbs. on drivers, and provided with 3,054 sq. ft. of heating surface, but it failed to do the work required.

The officials of the Erie then got together and gave interchange of ideas of the dimensions that might produce an engine that would haul their fast train on time, and have a margin of power and time to spare. The Pacific type of locomotive of the style shown was the result, and it more than meets the requirements.

The engine weighs in working order 230,500 lbs., so that it has the foundation of a very powerful machine. There are 149,000 lbs. on the drivers, the rigid wheel base is 13 ft., the total 33.8 ft., and the extreme length from point of pilot to back of tender 78.5 ft.

An engine of that weight and size can stand immense driving and steaming power. The cylinders, simple, are 22½x26 ins., the driving wheels are 74 ins. diameter, and the straight boiler is 73 ins. diameter at smallest ring. The fire box is 108⅛ ins. long inside, and 75¼ ins. wide, giving 50.53 sq. ft of grate area, while the total heating surface is 3.751 sq. ft. Steam is distributed by means of piston valves. The tender carries 8,500 gallons of water and 16 tons of coal. The tractive power of the engine, figured on 85 per cent. of the boiler pressure, is 34,000 lbs.



ERIE'S SUPREME EXPRESS ENGINE.

Geo. W. Wildin, Superintendent of Motive Power. American Locomotive Co., Builders.

On April 24 this engine, coupled on to a train of ten coaches weighing 1,208,050 lbs., at Jersey City, pulled it to Port Jervis, making the regular stops, in 2 hours and 18 minutes, which is seven minutes less than the schedule of No. 5. No very high speed was attempted, but in descending the long grade that ends at Port Jervis, a speed of 70 miles an hour was attained. A speed of 60 miles an hour was maintained on various stretches of straight track and during the long pull of 35 miles ascending a grade of 46 ft. to the mile, the speed never went below 35 miles an hour. Throughout this hard pull, which is the most exacting test a locomotive can be subjected to, the steam was constantly at the blowing-off point.

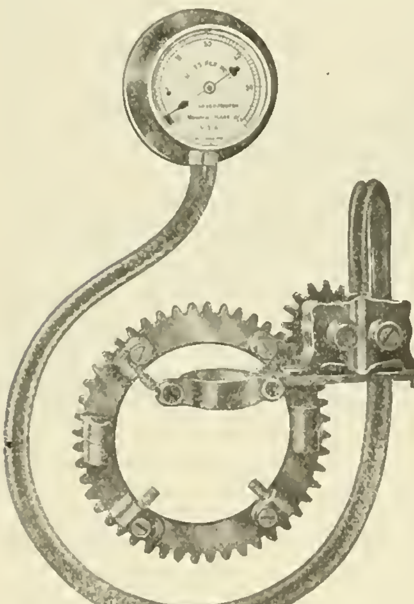
On the return trip an additional car

was added, making the weight behind the tender was 1,325,450 lbs., and the highest express train speed was made without difficulty.

The appearance of the engine is very harmonious, indicating careful designing for outline and details. The arrangement of the cab appliances is the same as those on the boiler head, illustrated on page 226, and are particularly worthy of attention, great care having been taken to have everything necessary in the operation of the engine within easy reach. No obstruction of any kind is between the engineer and the view of the track, an improvement that might well be generally imitated. The arrangement of cab appliances is the idea of General Manager Stuart, who began his railroad career in the locomotive department and takes a very practical view of having everything made convenient for the engineer.

New Speedometer.

A new speedometer has lately made its appearance and promises to fill a long-felt want. It is intended to indicate speed in miles per hour on a gauge made for that purpose. The gauge is graduated from zero up to 60 miles per hour, though higher speeds can be indicated when necessary by the application of a special gauge.



EASILY APPLIED SPEED INDICATOR.

The Wood Speedometer, for that is its name, is exceedingly simple in construction and operation, as can be seen from our illustration. The price is such as to put it within the reach of the individual, being listed at $25.

It consists of a recording gauge from which a united double tube rubber pipe of any required length passes to an air pump which is operated by a pair of gear wheels. The larger gear is made in halves, and has four adjustable set screws, so that it can be put round a car or tender axle and centered with as little trouble as a piece of work in a four jaw lathe chuck. The small gear is clamped to the pump shaft, so that when the wheel revolves the pump works. The smaller gear is made in different sizes so as to allow for the difference of wheel diameters from 28 to 36 ins. The pump is bolted by a convenient bracket to the truck frame where springs are not interposed between axle box and frame.

The pump is lubricated by any good quality of grease, which is introduced through a conveniently placed grease cup. Oil, if used, would probably be pumped into the gauge and derange its action. The principle upon which this speed indicating mechanism operates is that the faster the car wheel turns, the greater the amount of air pumped through the gauge, and the higher the figure reached by the pointer, and this gives miles per hour all the time.

Inventing the Natural Gas Meter.

Here is an incident illustrating how business problems pursue the inventor of the air brake.

A few years ago a game of whist was progressing smoothly, when, after one of the deals, Mr. Westinghouse did not pick up the cards, but kept drawing on a piece of paper before him. The others watched him curiously, remarked that they were ready to proceed, and then waited, unable to understand why he should pay no attention to them.

Suddenly, with a flash of triumph in his eye and exultation in his voice, he cried out: "Brown, I've got that natural-gas meter fixed—here it is; it cannot fail to work successfully," and picking up his cards he asked: "Whose turn is it to play?"—*World's Work.*

The Valve Motion Model.

We are pleased to inform our readers that we are now able to deliver the Valve Motion Model promptly on receipt of orders for it. Through unavoidable causes there were many delays in delivering the models, but there will be now no more reason for complaint.

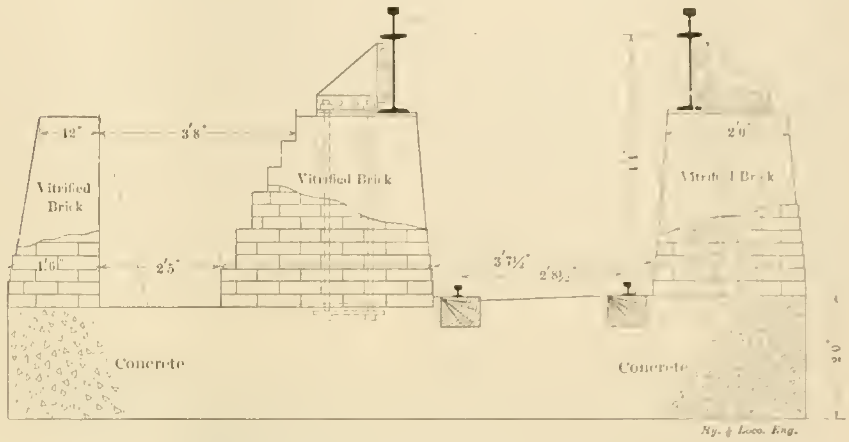
Quite a number of these models have been purchased for lodge rooms and other places where men are trying to understand the operation of valve mechanism, and it has proved highly popular. That fifteen dollar model enables a person to acquire a knowledge of valve motion as well as could be done by taking a part in setting the valves of a real locomotive, and it is much more convenient.

A model of this kind in our office is used almost daily to demonstrate the working of automobile cylinders with their four-cycle action of generating power.

Built-Up Ash Pit, P. & L. E.

The ash pits used on the Pittsburgh & Lake Erie Railroad at McKees Rocks and other divisional points on that system have been in operation for some time, and have given every satisfaction.

The pit is practically a concrete floor 53 ft. 7½ ins. wide by 125 ft. 6 ins. long, with a wall all round it. On this floor or foundation, are built a series of piers made of vitrified brick, which carry four tracks in the direction of its length. girders are 4 ft. 4 ins. above the floor of the pit, and upon them 80 lb. steel rails are laid. Between the piers and under each track light lorry rails are laid 2 ft. 8½ in. gauge upon which the ash pit buckets, mounted on a suitable frame can be run from one end of the pit to the other. These buckets when full are run under an electric hoisting apparatus which lifts the buckets out of the pit, conveys them to the ash bin and there automatically dumps their contents.

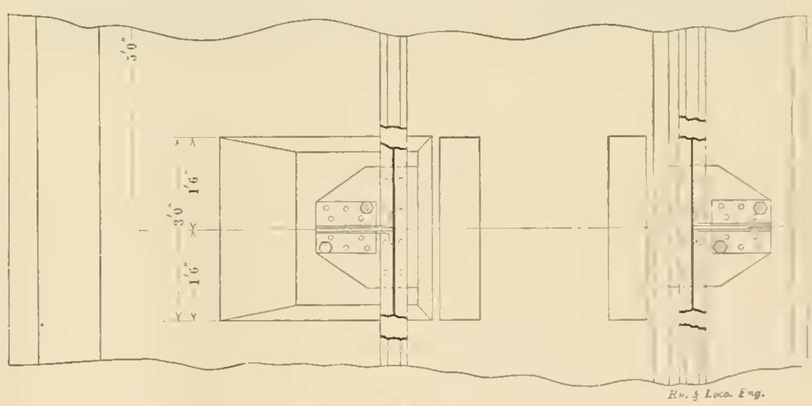


SECTION OF CONCRETE ASH PIT ON THE PITTSBURGH & LAKE ERIE, McKEES ROCKS, PA.

There is therefore about 500 feet of track available for the cleaning of ash pans, etc. The outer rails of the two outside tracks are carried upon the side walls of the pit and the whole pit floor is sloped for drainage.

A general idea of the pit construction can be gained by reference to the engravings, which show a section of the outside wall of the pit and one of the piers. These piers are spaced 5 ft. apart from center to center, and on top of them and on the inner edge are laid steel I-beams 15 ins. deep and weighing 42 lbs. to the foot. These girders are secured to each pier, and at equal intervals along the outside walls by built-up knees formed of angles and plates. These knees are securely anchored down by rods which pass into the concrete foundation of the pit. The top of the

The pit is supplied with water pipes, and conveniently placed hose connections enable the hostlers to readily quench the live cinders, and the concrete and vitrified brick construction of the pit have lasting qualities of a high order. Ash pans of the large locomotives have been cleaned in an average time of 6¾



PLAN OF PIERS AND SIDE WALL OF P. & L. E. ASH PIT.

minutes. We are indebted to the engineering department of the P. & L. E., of which Mr. J. A. Atwood is chief engineer and Mr. A. R. Rayner assistant chief engineer, for the information concerning this ash pit.

Growing Popularity of Steam Turbines.

That the steam turbine and turbo-generator are destined to be one of the greatest power developing and distributing factors is evidenced by the number of units of this type which have been installed, and which are now in the process of construction. Owing to the restrictions placed by reciprocating engine speeds upon the designs of engine type generating machinery, their dimensions and bulk, as also the cost, have increased enormously in the past few years with the increase in capacity. With the advent of the steam turbine the speeds have increased so as to secure in generator construction minimum bulk and cost consistent with strength and durability.

A striking example of this may be seen in the power equipment of the Rapid Transit Company in New York. Turbine type generators with a rated output of 5,000 kw., weighing 234,000 lbs., run at 750 r.p.m. Generators of the same output driven by reciprocating engines at a speed of 75 r.p.m., weight 980,000 lbs. Orders for eight turbine generators have been placed with the Westinghouse Electric & Manufacturing Company in the past few days, mostly for 400 and 500 kw. units, with one 2,000 kw. and one 2,500 kw. machine.

The "Confessions of an Oil Fiend" is a good thing to read. It isn't long and it is humorous and moreover it's true to life, to the very last drop. It was written by John Alexander, who says he left a trail of wasted oil behind him thirty-six years long. Then he came upon a real oil can! The way to get the "confessions" is to write to the M. & S. Oiler Company, 516 Equitable Building, Denver, Col., and they will send you the little eight page book, which will fit in your vest pocket. They will send it free of charge and you can read it and smile over it, if you don't want to laugh out loud—and think! the M. & S. oil can is the one Skinny Skeevers thought a lot of and ordered every time when his requisitions were not hacked to pieces. It is worth looking into, we mean the serious subject of oiling, but the can is worth looking into too. It has an air chamber and a vent and a valve which stops the flow of oil when you want it to stop. The can is made out of No. 22 gauge cold rolled steel and costs $2.00, and nothing but accident or rank abuse can break or wear one out. Write for the little book first and then you will know if you want to write for the can.

Useful Catalogue.

A very handsome catalogue fresh from the press has been issued by the Hancock Inspirator Company, Liberty street, New York. It is standard railway publication size, that is to say, its pages are of the same dimentions as those of RAILWAY AND LOCOMOTIVE ENGINEERING. The first two pages are devoted to some remarks on the history of the Hancock inspirator. The Hancock locomotive inspirator was evolved from the first and its construction, method of working, etc., are briefly touched on. The various types of inspirators are illustrated and their size, price and capacity are duly set forth. Sections are also given with internal parts shown and numbered and named for ordering. Line cuts of proper reseating tools for these inspirators are given. These are made by the company.

Several pages are devoted to directions for maintenance and repairing of the several types made and others to directions for connecting and operating the inspirators. The last half of the catalogue gives illustrations and descriptions of the Hancock valves, checks, pipe fittings. The pneumatic blow-off valve is shown in elevation and in section with parts numbered and named, with price. The new Hancock globe, angle, sixty-degree and cross valves which were referred to in our issue of January, 1905, is illustrated

MODERN WOODBURNER HAULING PASSENGER ON THE SEABOARD AIR LINE.
Photographed by F. W. Blauvelt.

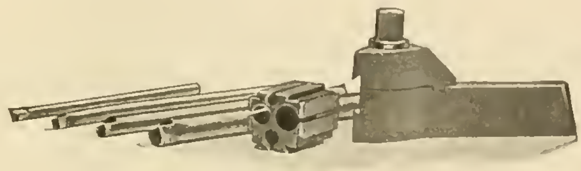
and fully described. Altogether this is very useful catalogue and book of reference for these Hancock specialties. It has a good index at the end and is bound in cloth with stiff covers. A copy will be sent to motive power officials who apply to the company.

Air Brake Questions and Answers.

The pamphlet issued by the Air Brake Association and sold for 25 cents has been exhausted and no more of them will be printed. A committee of that association has prepared a much more exhaustive treatise on air brakes and the price is two dollars. It is a great rise in price, but the new book is more than worth the money charged for it. We make the request that our readers will stop sending to this office for the old pamphlet, as we do not have a single copy, and there is no more to be had.

Boring Tool Holder.

A quickly handled and very ingenious boring tool holder has recently been put on the market by Carr Brothers of Syracuse, N. Y. The tool holder is made of steel, drop-forged and case-hardened. The shank is held in the tool post of the lathe in the usual way, and the outer portion has a pair of jaws which may be brought together by screwing down the clamping bolt shown in the illustration. The boring tool holder is made in block form and fits into the jaws of the clamp. The block is made to take ¼, 5/16, ⅜ and ½ in. round steel and the cavities in the block suitable for these sizes have each a slot cut through on the outer face. The tool can be set at any angle and may project any required distance. The act of clamping the block, grips the cylindrical body of the boring tool. Freedom of movement in all directions and a firm hold when tightened in place are the principal features of this device. Write Carr Brothers if you require further information on the subject.



CARR BROTHERS BORING TOOL HOLDER.

Removal of American Steel Foundries.

The executive offices of the American Steel Foundries until lately were located at No. 74 Broadway. With the object of concentrating all of the departments of this well-known concern it was found necessary to lease the entire eleventh floor of the recently completed building known as No. 42 Broadway, and henceforward communications should be sent to this new address.

It is well known that in the new movement towards consolidation of allied industries one of the chief elements of success involves the systematizing and harmonizing of every branch of the business. With this end in view the executive officers of the American Steel Foundries are inaugurating, simultaneously with the removal, a new system of accounting and distribution of orders, which will improve the organization and simplify their work. This will assist them in taking care of the many large orders they are receiving due to the increased demand for new equipment by the railroads and other large producers. The output of their eight plants for all kinds of steel castings is enormous, and they are always in a position to undertake new work and make prompt deliveries. With the acquisition of the Simplex Railway Appliance Company they are even better equipped than ever to fill the requirements of railroad companies and car builders.

The Commercial Acetylene Company, of New York, have issued a small folder concerning what they claim to be the absolute safety of their safety storage system of acetylene lighting. The folder simply contains the facsimile of two newspaper clippings taken from the *Chicago Evening American* and the Chicago *Daily News*, both of March 18, 1905. Both these cuttings refer to a harmless explosion made for the subcommittee of the gas, oil and electric committee, which was investigating the method of storing acetylene. The test was made by the Acetylene company before the subcommittee for the purpose of giving a demonstration as to the best method of storing this gas. A cylinder 4 ins. in diameter and 38 ins. in length, filled with asbestos and 43 per cent. of acetone, and then charged with acetylene to 150 lbs. pressure and exploded. No damage of any kind was done beyond the shattering the experimental cartridge, which was a mild affair. The Acetylene company will be happy to give further information to those interested.

Mr. George M. Sargent as a Golfer.

Only a few years ago one of the most popular railroad supply men was George M. Sargent, who introduced the Congdon brake shoe and took a leading part in the introduction of other railroad appliances of recognized merit. Mr. Sargent worked hard while he was in business, and laid up the wherewithal to maintain himself and family in comfort in the sunset of life, and like a sensible man retired from the cares of business at a green old age to enjoy himself. He now resides in Evansville, Ill., and as a source

GEORGE M. SARGENT AND HIS FELLOW GOLFERS. MR. SARGENT ON THE RIGHT.

SARGENT-WILSON vs. LACEY-PEARSONS
BELLEAIR GOLF CLUB
FOUR-BALL FOURSOME PLAYER, MARCH 29th, 1905

			S	W	L	P				S	W	L	P	
1	262 yds., Bogey 4	1	6	5	7	6		10		6	6	6	5	2
2	272 yds., Bogey 4		6	8	6	5	1	11	7	5	5	6	5	
3	215 yds., Bogey 4	2	5	4	6	4		12		8	5	5	5	3
4	273 yds., Bogey 4	3	7	5	7	7		13	8	6	5	7	5	
5	401 yds., Bogey 5	4	6	6	7	6		14		5	8	7	5	4
6	370 yds., Bogey 5		6	6	7	5		15		7	6	6	6	5
7	300 yds., Bogey 4	5	6	7	6	8		16		5	6	5	6	
8	148 yds., Bogey 3		4	5	5	4		17	9	3	4	5	4	
9	197 yds., Bogey 4	6	3	5	6	6		18		5	6	5	4	6
	2438—37		49	51	57	51		2438—37		50	51	52	45	

S 99
W 102
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P 96

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Best Balls

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Thermometer 82 at 11 o'clock

Sargent's Birthday—75 years old—Young.
Sargent played without golf glasses.

of enjoyment and health conservation has taken up the game of golf, and plays with warm enthusiasm and no little skill.

Mr. Sargent recently played a game of eighteen holes on his seventy-fifth birthday with three other veterans, and we are pleased to reproduce a picture of the venerable players and a table of the score made. Golf is not much in the line of RAILWAY AND LOCOMOTIVE ENGINEERING, although its editor is president of a golf club, but we know that there are a sufficient number of Mr. Sargent's friends among our readers to justify the publication of particulars about this match. Moreover, we find that many railroad men have become enthusiastic golfers, and it may be in order some day for us to devote a department to the game.

The numerous friends of Mr. Sargent will be pleased to see that he is looking so hale and hearty, giving promise of many years of enjoyable life. Of course, hundreds are acquainted with his sons, William and George, who are both a credit to the railroad manufacturing business and promise to follow in the footsteps of their noble father.

An Object Lesson With an Object.

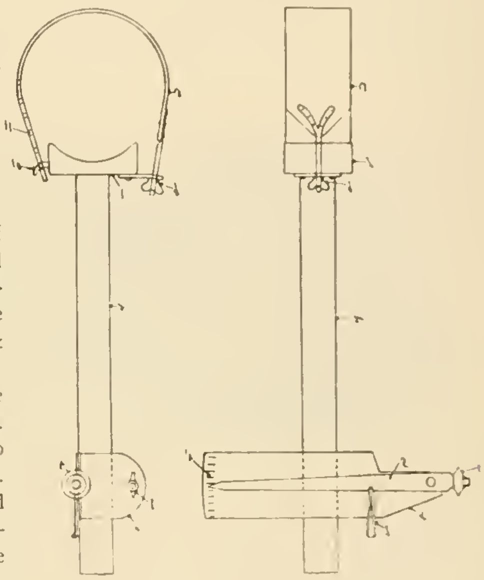
It was a representative gathering of merchants, manufacturers, professional men, bankers, real estate men, capitalists, etc., which recently gathered at the railroad repair shops of the C., R. I. & P. in the good town of Moline, Ill.

About four hundred came to visit the railroad plant on invitation of Mr. A. W. Wheatlie, the shop superintendent, who met and welcomed them as they arrived. The whole place was thrown open and ample time was given for a thorough inspection of all departments. All the shops were in full operation and the visitors roamed about at will. About one hundred locomotives were in the erecting shop in the various stages of dismemberment, which marks the stripping and the building up processes. From the machine shop the visitors wandered to the power house, store house and other buildings. All were interested and deeply impressed with the magnitude of the plant and the importance of the work. Before the train which took the visitors left, the enthusiastic party gave three cheers for Mr. Wheatlie.

The object which the railroad company had in view in thus inviting the inspections of representative citizens in all walks of life was to interest those who were in a position to invest money in what ought to be a profitable venture, namely, the building of houses for workmen in the neighborhood of the shops. This would be a mutual advantage to the townspeople and the company and their employees. Many of the visitors expressed themselves favorable to the project since they had seen with their own eyes the permanent character of the works, and the possibilities of still further enlargement as the company's needs warrant it.

Wheel Gauge and Caliper.

The wheel gauge and caliper, as will be seen by the illustration, is composed of an upright piece, 2, on the lower part of which is arranged a strap adjustment to fasten around the axle. On the top end of the upright piece is a calipering arrangement. This device is attached to the journal of the wheel, being adaptable to any size journal by hooking any of the holes, 11, in the strap, 3, on a small hook, 10, and afterwards adjusting the thumbscrew, 9. The calipering arrangement on the upper end of the device may then be used to note whether the wheel is out



WHEEL GAUGE AND CALIPER.

of round or there are any low spots on the tread. The pointer, 5, and caliper, 6, will show plainly the condition of the tread of the wheel.

JOHN HUME, JR.,
General A. B. Inspector Houston & Texas Central R. R.
Houston, Texas.

A special application of the steam hot blast system of drying has recently been made by the B. F. Sturtevant Company, of Boston, in the Beaver Falls plant of the Armstrong Cork Company. The installation consists of a regular engine driven fan and tempering coils, with a system of galvanized iron distribution ducts. Through these ducts the heated air is positively forced to the tempering floor where it accomplishes the delicate process of dr-ing the thin sheet cork insulation without harmful effect.

The American Brake Shoe & Foundry Company beg to announce the appointment on May 1 of Mr. W. S. McGowan, Jr., as eastern sales manager, with headquarters at 170 Broadway, New York City. This is opposite our old quarters, and is on the corner of Maiden Lane and Broadway. It is a central location and easily found.

H. W. Johns-Manville Co., of 100 William street, New York City, the well-known manufacturers of asbestos materials, have recently appointed Mr. T. T. Lyman to the position of general sales manager of the company. Mr. Lyman has been connected with the company for many years.

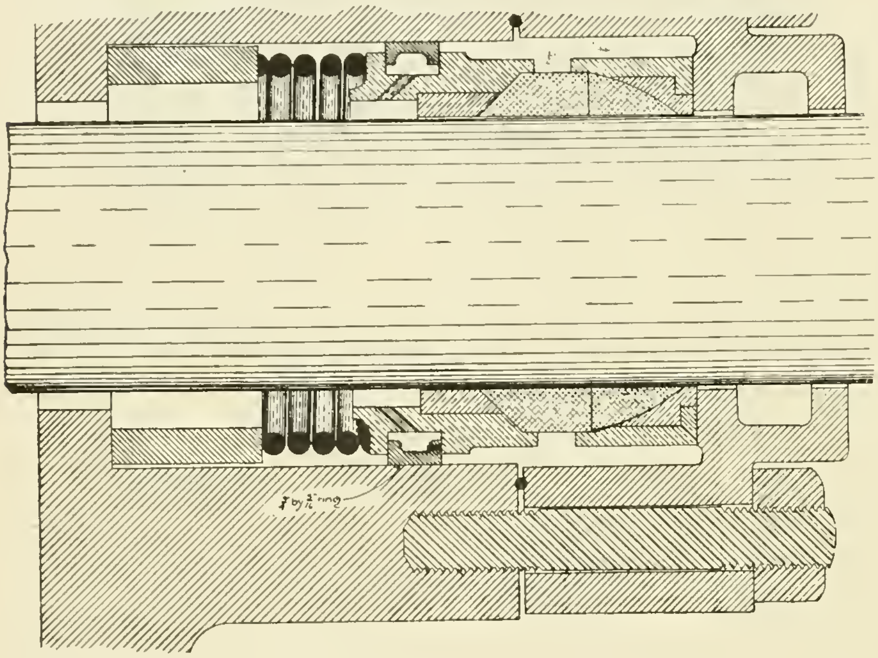
American Perfection Piston Packing.

The illustration here given is of a metallic, valve stem and piston rod packing that is intended to meet the exacting requirements of modern service. It has passed the experimental stage, and on those lines where it has been tried during the past few years it has been adopted as the standard packing of the road. The expansion ring, which one observes immediately back of the compressed coil spring, is something new in rod packing, and its purpose is to prevent steam escaping from the cylinder and to reduce the pressure on the sides of the metallic packing itself. To set out this packing solidly against the walls of the stuffing box, diagonal openings have been introduced in the back cone underneath the expansion ring for the admission of steam.

The metallic packing itself consists of only two rings of peculiar shape, but which present flat surfaces to each other. There is no possibility of one ring being forced past the other, nor is there any danger of either being squeezed flat and working out of the gland in the form of thin sheets.

The gland contains a cavity for a swab, which when once supplied with a lubricant requires very little further attention from the engineer. The entire arrangement of gland, cone and packing allows a greater amount of lost motion to exist between the crosshead and the guide bars than is usually permissable.

The packing is known as the American Perfection Piston Packing, and was invented by several railroad men of Wichita, Kan. So confident are they of its superiority that they are willing to give a written guarantee concerning it to any user of the packing.



NEW DESIGN OF PISTON ROD PACKING.

The Niles-Bement-Pond Company have leased an entire floor in the new Trinity building at 111 Broadway, New York, and will be located there after May 1; the executive offices have been in New York since the organization of the company under its present title. The Niles-Bement-Pond Company employ about 5,000 workmen, and have two factories in Philadelphia, Pa., one in Hamilton, Ohio, one in Plainfield, N. J., and they also own the Pratt & Whitney Company, at Hartford, Conn. All these plants are devoted to the building of iron working machinery.

There are some good examples showing what different kinds of jacks look like in a pamphlet which recently came into our office. It is bulletin No. 12, issued by the Buda Foundry and Manufacturing Company, of Chicago, and called "Jacks." Among the list of jacks is the Buda ball-bearing car jack with a 20-in. lift. Then comes the ball-bearing locomotive jack, standing two ft. high with eleven in. lift and a heavy hanger grasping the head and coming down the side with a foot like that of a track jack. This foot is only an inch or so from the ground, but strangely a foot can often lend a helping hand to get a low down weight off the ground. There is also a cone bearing journal jack which only stands up 9½ ins. from the ground and has a rise of 4 ins. These are only a few of the jacks to be seen in this bulletin. There are track jacks and bridge jacks and ratchet jacks, etc., etc. Write to the makers of these jacks if you would like to get this bulletin or to find out anything further on the subject of jacks.

The H. A. Rogers Co., of 19 John street, New York, announce that they have made permanent arrangements with Mr. E. W. Saunders to devote special attention to the machine tool department which has always been an important adjunct of their business. Mr. Saunders has for many years been identified with the machine tool trade in New York, and being well versed in machine tools and their uses, his views will benefit purchasers, especially those seeking outside aid in selecting plants for manufacturing machinery on the interchangeable plan with greatest economy.

One of our most talkative of the old class of engineers has a habit of assuring younger men of the student class that he knows all about valve motion, air brakes and injectors, and could be our instructor on those subjects if he could only find words to express himself. He states that he is starving for want of words, and at the same time never ceases to waste them like an automobile horn. We often wonder if this class of man is ignorant of the fact that want of knowledge is why he cannot tell facts about railway mechanism. He goes on the old principle of diplomacy that speech was invented to hide ignorance.

The South Side Elevated Railway Company, of Chicago, has contracted with the Westinghouse Electric & Manufacturing Company for complete equipments for seventy cars, which includes one hundred and forty 75 h.p. motors, and multiple control apparatus. The motors are of special design and are in line with the re-equipment of this system. The cars will be operated in trains of five, three of which will be motor cars.

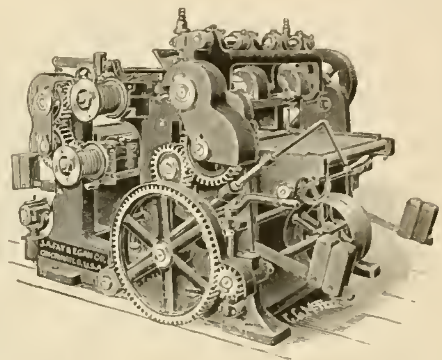
About fifteen engineers have been set back to firemen on the Central Division of the New York Central Railroad. The business on the railroad is always dull at this season of the year, and many trains in the freight department are not needed. As soon as the summer schedule is adopted these men will be reinstalled as engineers.

Improved Planer.

In the surfacing machine represented by this cut are united the latest improvements and the best features which have stood the test of service. This is a machine of large capacity and capable of finishing work very smoothly in car shop planing mills.

All studs have been eliminated, and it is presented as the highest type of double surfacer of its size or weight, and its great strength will be sure to commend it to all users of such machines. It was patented December 19, 1899, and May 2, 1900.

This tool will plane material on both sides, 30 ins. wide and up to 8 ins. thick. The frame is hollow, giving great strength, with comparative lightness,



NEW NO. 140 DOUBLE CYLINDER PLANER

and it has a broad base. The cylinders are four-sided and are slotted on each side, carrying four knives when so desired. The lower cylinder is placed as close as possible directly after the upper cylinder, insuring very accurate work and for planing very short pieces. It may be drawn out at the left side of the machine for setting the knives, and is adjustable for a varying amount of cut.

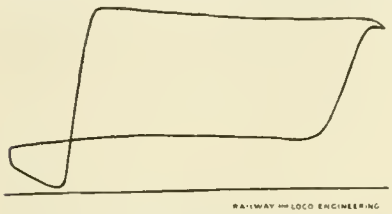
The bar before the upper cylinder is solid or sectional, to correspond with the top feeding-in roll. The bed is very solid and is raised and lowered on screws mounted on ball bearings and operated by a crank. The four feed rolls are powerfully driven by heavy gears, which have an outside bearing, thus giving to the train of gears and to the expansion gears a bearing on either side, thus doing away entirely with the use of studs.

The feeding-in roll is solid, divided in four sections, enabling the feeding of pieces of varying thickness through the machine at one time. The roll, whether solid or sectional, is driven by a gear in the center of each section, thus insuring a powerful feed. The upper feeding-out roll raises and lowers parallel, which gives a perfect bearing on the material at all times. The feed is under instant control of operator, and rate is furnished as desired.

Further particulars and catalogue of woodworking machinery can be had free on sending post card to J. A. Fay & Egan Co., of Cincinnati, O. A book on band saws may also be had on application.

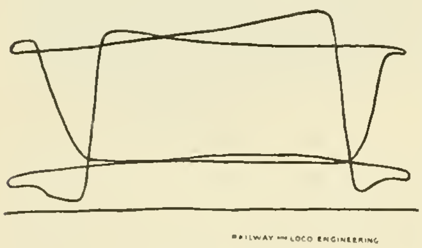
Curious Indicator Cards.

An assistant superintendent of motive power of a large trunk line recently sent us the two indicator diagrams which are here represented. Our readers



STEAM END CARD FROM AIR COMPRESS, BACK STROKE.

are requested to criticize and interpret the same. They were taken from the steam cylinder of an air compressor engine, and show the steam pressure as doing some curious looping the loop



CARD FROM STEAM END OF AIR COMPRESSOR ENGINE.

stunts inside at the time. The cylinders were 18 x 22 ins. and the boiler pressure in both cases was 150 lbs. per square inch. Speed, 42 revolutions per minute.

If you want a good file catalogue, the one issued by the G. H. Barnett Company, of Philadelphia, would probably suit you. It is a neat little publication of 46 pages, measuring 6½ x 5 ins. This company owns the Black Diamond File Works, and all styles of files are turned out. Those usually employed in locomotive work are the deadsmooth, smooth, second cut, bastered, middle and rough, and the relative fineness of cut in each is shown in a series of small square half tones. The kinds of files used in saw mills and lumber camps, and those suitable for blacksmiths, cabinet makers and plumbers are also given. A series of illustrations give more in detail the form and appearance of each file made and the correct name and length are indicated. The catalogue makes ordering easy, and gives one a good idea of the large variety of files and the quality of work turned out by the Barnett Company. The catalogue will be sent free to any one who will write to the company with the request for a copy.

Adreon & Company, St. Louis, announce that they have secured exclusive selling rights covering the United States railroad trade for "Anti-Selenite" Boiler Scale Solvent. This compound is manufactured in Monterey, Mexico, and its basis being vegetable, it protects instead of injures the metal in boilers, and is remarkably effective in removing scale under all conditions. It has been subjected to exhaustive tests in this country by all classes of steam users, and reports on file prove every claim made for it by the manufacturer. "Anti-Selenite" received a gold medal, the highest award at the Louisiana Purchase Exposition, against 72 competitors.

The Falls Hollow Staybolt Company have received a large order for hollow stay bolts from the Western Australian government for use on the locomotives of that colony's railways.

The Noiseless Car & Car Wheel Company, of New York, have two of their car trucks with noiseless wheels on exhibition in the shops of the Elevated Railroad, New York.

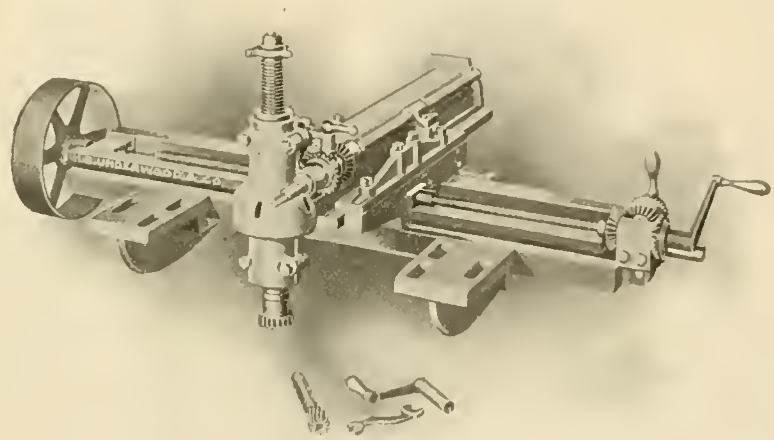
Mr. F. H. Jones has been selected to organize a sales and publicity department of the International Steam Pump Company. Mr. Jones was formerly manager of the Air Compressor Department of the company. He is a graduate of Cornell University.

A Delightful Resort.

In the early part of the nineteenth century there was a great hunter named Browning who owned nearly all of the country in the vicinity of Deer Park, Md., and the country was considered a paradise for hunters and sportsmen. In the course of time the Baltimore & Ohio Railroad, which naturally selected the great plateau as a convenient place to cross the mountains, went through this territory and accumulated much of the property. It devolved upon that company later to see the advantages afforded by the mountains in this section and establish a summer resort, with the consequent building of Deer Park Hotel. Pittsburg, Washington, Baltimore, Philadelphia, New York and Cincinnati always have a full representation, owing to the convenience of the through train service from these points. A great number come from the South, and while Deer Park is never represented as a health resort, it is, nevertheless, a place absolutely out of the reach of malaria germs, and hay fever is unknown.

Portable Milling Machine.

If the mountain will not go to Mahomet, Mahomet will have to go to the mountain. That is perhaps as nearly as may be the principle upon which depends a great deal of the usefulness of the handy little portable milling machine which is shown on this page. It was originally designed and built for facing steam engine valve seats, but it has been found to have a wide range of roundhouse and railway repair shop work. It is made by H. B. Underwood & Co., of Philadelphia, and it gets in its fine work wherever it is easier or quicker to put a portable milling machine on a job than to take things apart and send them to the shop. Thus it is like Mahomet, for it comes to the mountain and soon makes a mole hill out of it.



HANDY PORTABLE MILLING MACHINE.

The machine is strongly geared and has power feed in both directions and can be used in any position. It will face a valve seat 22x36 ins. and 7 ins. deep. It can be driven by hand power or small steam engine, or by compressed air, or electric motors. The machine does not mind what kind of power is supplied to it. If it gets enough it is capable of doing rapid and accurate work.

The portable miller is easily attached to any steam chest, after the cover has been taken off. To do this the clamp brackets are bolted to the steam chest studs and the machine is then bolted by T-slots on the underside of the bed to the clamp brackets and it is ready for work.

The spindle is bored for a Morse standard taper. The standard machine has a bed 48 ins. long, its crosshead is 36 ins. long and the spindle has a length of 19 ins. The spindle diameter is 1¾ ins., that of the driving shaft 1⅛ ins., and that of the feed screws ⅞ ins. The clamp brackets weigh 80 lbs. and the whole machine ready for use turns the beam at 500 lbs.

The Walworth Manufacturing Company, of Boston, have a number of cards which easily fit in an ordinary envelope and each one is devoted to explaining in a few words the merits of one of the many shop tools and devices made by this well known concern. There is, for instance, the Kingpost pipe vise, the size, price and general appearance are given with a few words of explanation. Then again there is a little table giving the dimensions of parts and prices of reversible ratchet die plates and an illustration of the same. The "Ruff and Tuff" dies have a little card to themselves like the others. If there is anything in their line you want a compact bit of information about write the Walworth Company for one of these cards.

A Concrete Recipe.

We extract this item from a little standard size pamphlet got out by the Engineering Company of America, in this city. "A typical concrete is made as follows: To one barrel of standard Portland cement are added three barrels of clean sharp sand. The two are intimately mixed, either manually or by a mechanical mixer, and then enough water is added to bring the mixture to a certain consistency, the proper amount of water being judged by one experienced in this work. Five barrels of broken stone are then added, the whole thoroughly intermixed, and the concrete thus formed is ready to be conveyed to the forms or the excavations prepared for it. Concrete made in the above proportions would be known as a 1-3-5 mixture. The permissible proportions, however, vary widely, 1-2-4 to 1-5-10, according to the nature of ingredients and the service for which it is intended. In general, concrete with the smaller proportion of cement will not sustain the same strains as the concretes wherein the proportions are about as indicated in our typical mixture."

Duplex Milling Machine.

We are here able to illustrate and briefly describe a very useful tool for railway shop repair work. This machine with its two heads will surface both sides of a piece of work at one time, and while it has the range to take in large work it also has ample power in the spindles and feed to take the heaviest cuts on same at high speeds. It is made by the Becker-Brainard Milling Machine Company, of Hyde Park, Mass., and has been built from new designs and is intended to combine rigidity and power.

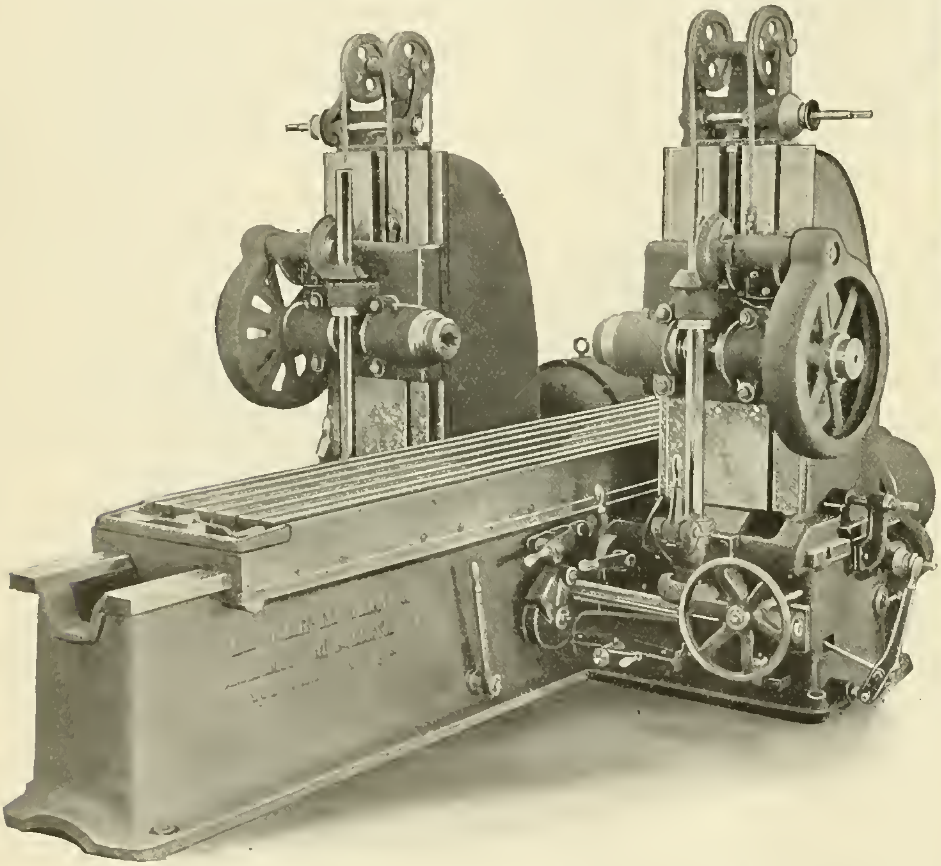
The spindles are made of hammered crucible steel 5 ins. in diameter. These run in self-centering bronze boxes, and are provided with nut and check-nut to compensate for wear. The spindle carriers are heavy and are held firmly to the uprights by long gibs. This mechanism is raised and lowered by the movement of a screw with adjustable dials, which are graduated to thousandths of an inch and counterbalanced for ease of operation. The spindles are driven through gearing by a 5 in. belt on a five step cone; the largest step is 23 ins. diameter and the smallest 13 ins., thus giving gear ratios of 13½ and 27 to one, thereby allowing 20 changes of speed.

When arranged for motor drive, a 15 h.p. motor is required, having a speed variation of 2 to 1, and running from 600 to 1,200 revolutions per minute.

The table is very heavy, and is made with five T-slots lengthwise, and an oil channel the full length of each side and at each end. It travels on flat ways securely gibbed, and has a quick traverse in either direction by power. It can also be moved by a hand wheel.

The feed of the table is directly operated through gearing from the main driving cone, giving a range of feed through eight changes from .032 to .535 ins. These changes of feed can be made instantly, by means of a lever and without stopping the machine. The heads may be adjusted from either side of the machine, and cutters can be adjusted independently. The bed is extra deep, extending to the floor, and making a solid foundation. It is securely braced by heavy cross girders, which are evenly spaced throughout its entire length.

The working surface of the platen is 120 x 26 ins., and the length of the bed is 168 ins. The greatest distance from center of the spindles to the table is 28 ins., and this can be diminished to 2 ins. The greatest distance from end of a spindle

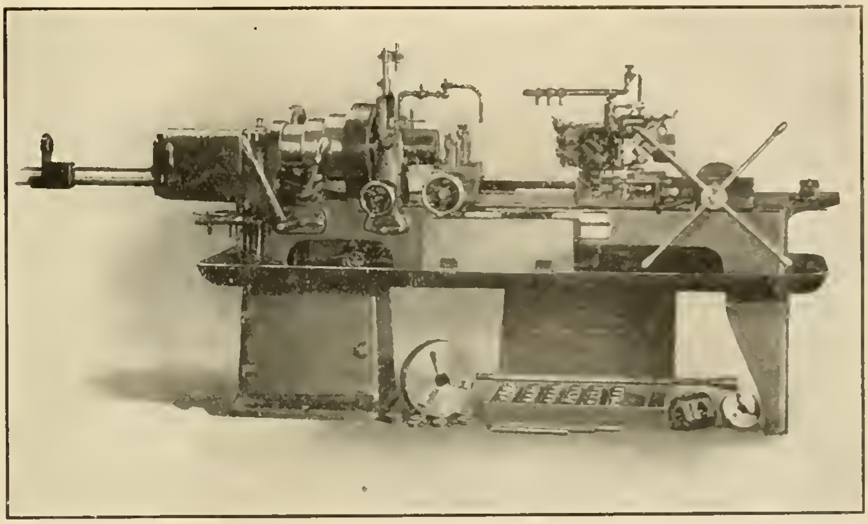


BECKER-BRAINARD DUPLEX MILLING MACHINE.

to the center of the table is 16⅜ ins., and this distance comes to a minimum of 6¾ ins. when the spindle has been moved in. The greatest distance between spindles is 32¾ ins., and the least distance that can exist between them is 13½ ins.

New Turret Lathe.

The turret lathe in the locomotive shop is a very useful machine, but to handle with advantage the variety of work which was formerly done on engine lathes, the turret lathe requires a special equipment. One of the chief uses of such a lathe in the railway repair shop is for turning bolts, and all ordinary bolts can be turned without the use of special equipment, but when it comes to turning the long taper bolts used in locomotive frames, a special taper turner is provided, which is usually arranged for the standard taper for locomotive bolts, which is 1/16 in. taper per foot.



PRATT & WHITNEY TURRET LATHE.

Another class of bolt work for which this machine is adapted is that of centering and turning forge bolts, the heads of which are usually more or less eccentric. The lever scroll chuck shown in our illustration is mounted on one of the turret faces, and in it the body of the bolt is placed. The shank of the forging chuck, which has two floating jaws, is placed in the regular chuck jaws in the spindle. The turret is then run forward, and the bolt, the body of which is held in the scroll chuck, is run into the forging chuck and the jaws tightened on its head. The scroll chuck is then opened, the turret run back and indexed to the first turner required, and the turning proceeded with. The fact that the bolt is held in the scroll chuck while it is being clamped by the forging chuck, ensures its being centered correctly.

The regular equipment of this machine includes a full set of chuck jaws from ¾ to 2 ins. in diameter, handling round, square and hexagonal stock; three universal turners, each with radial adjustment, which enables them to be used not only for ordinary turning, but for facing off bolt heads, etc.; one open side turner for bolts and pin-heads, above 2 ins. in diameter; one taper turner; one bell-mouthed pointing tool; one self-opening die head, with roughing and finishing attachment, and also provided with a full set of thread dies; one 6 in. lever scroll chuck; one forging chuck; one 12 in. combination lathe chuck; bushings, collars, rod supports, etc. It is evident from this list of tools that the turret lathe, with what may be called locomotive shop equipment, is adapted for doing a wide variety of engine lathe work, and it will do this work in less time than it could be done on an engine lathe. The double cross slide on these turret lathes is of particular value, as it enables work to be cut off while turning is in progress, and it can also hold heavy forming tools. The makers of these tools are the Pratt & Whitney Company, of New York.

Nail That Rap to the Counter.

The expression used as the heading of this item had its origin in Ireland some time in the eighteenth century when small spurious coins were easily passed. The retail merchant often on ascertaining that a rap was counterfeit nailed it to the counter so that genuine coin might be compared with it.

Nailing the rap to the counter is practically what Mr. D. T. Edwards, the passenger traffic manager of the Cincinnati, Hamilton & Dayton Railway, has done in dealing with a flood of counterfeit tickets purporting to have been issued by the C., H. & D. which have been presented for passage on trains of connecting lines. The passenger department hit upon the idea of photographing and making a colored facsimile representation of the genuine and the spurious tickets and printing them on one side of a circular with a few brief easily understood notes indicating the points of difference. The circular was printed on paper of convenient size for conductors to carry in their pocketbooks, and the demand for these circulars from C., H. & D. connections has been prompt and urgent.

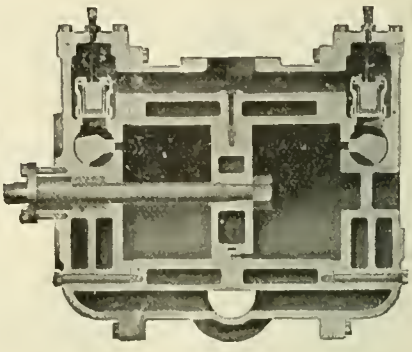
The device of the circular by which any conductor can nail the rap to the counter is a clever and a businesslike one, and it is to be hoped that the "Great Central Route" now has the counterfeiters "on the run."

The well-known firm of William C. Baker, 143 Liberty street, New York, makers and owners of the Baker car heaters, inform us that they do not have a separate exhibit at the Railway Appliance Exhibition in Washington. They have, however, one of their riveted steel shell heaters on the grounds. It is to be seen in the Gold Car Heating & Lighting Company's exhibit. Railway companies in general are recognizing the fact that it is best to order heaters and repair parts direct, having learned that suits are pending against carbuilders and others, and infringements are best avoided. Since Mr. Baker's death, four years ago, the business has been managed by C. A. Baker, under whose careful eye it has grown most satisfactorily. There has never been any discontent, much less any strikes at the works; the men do their very best for their manager. Mrs. A. F. Walker represents the firm at the Exhibition.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Co., sailed last month on the "Kaiser Wilhelm II" for a five weeks' trip to Europe, in the interests of the pneumatic tool business, taking with him five styles and sizes of electric drills for which the trade of the Consolidated Pneumatic Tool Co. have been eagerly looking. Important tests and orders are awaiting Mr. Duntley's arrival. Business with the Chicago Pneumatic Tool Co. is reported to be the best in its history, as far as the number of tools sold is concerned. Foreign business, we are told, has also increased considerably, and seems to indicate that the year will be the best in the history of the pneumatic tool business.

The month of May is moving time, and the American Locomotive Company are changing their New York offices this spring. The old address, as most people know, was 25 Broad street. The new address is at 111 Broadway, New York, which is a locality easy to remember. It is in fact the Trinity building, and is not far from New York's historic church.

The many friends of Mr. George A. Cooper will be pleased to hear that he has accepted the position of sales agent for the Frost Railway Supply Co., of Detroit.



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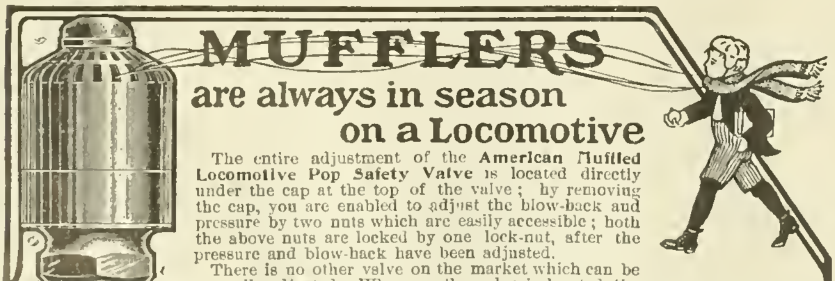

Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVIII. 136 Liberty Street, New York, June, 1905 No. 6

Railway to the Oldest City in the World.

Our illustration shows a stone viaduct on the Damascus & Mecca Railway. The view shows a construction train at work on the road which is being built by Turkish soldiers. The character of the country is fairly indicated by the want of verdure and the dry, hard ground, and it fully justifies Mark Twain's description of it. We have made a few brief extracts from the "Innocents Abroad," which tell in a few words all that need be said of Damascus, the oldest city in the world. The author, speaking of the city, says:

"When you think of the leagues of blighted, blasted, sandy, rocky, sunburnt, ugly, dreary, infamous country you have ridden over to get there, you think it is the most beautiful, beautiful picture that ever human eyes rested upon in all the broad universe.

"There is an honored old tradition that the immense garden which Damascus stands in was the Garden of Eden, that the rivers Pharpar and Abana are the 'two rivers' which watered Adam's Paradise. Damascus has plenty of clean, pure water in it. Water is scarce in blistered Syria, but the 'rivers' of Pharpar and Abana of Scripture (mere creeks) run through Damascus, so every house and every garden has its sparkling fountains and rivulets of water. Damascus is simply an oasis—that is what it is. For four thousand years its waters have not gone dry or its fertility failed. Now we can understand why the city has existed so long. It could not die.

"Damascus dates back anterior to the days of Abraham, and is the oldest city in the world. It was founded by Uz, the grandson of Noah. Go back as far as you will into the vague past, there was always a Damascus.

"She saw the foundations of Baalbec and Thebes and Ephesus laid, she saw these villages grow into mighty cities,

A VIADUCT ON THE DAMASCUS & MECCA R. R., NOW BEING BUILT BY TURKISH SOLDIERS, SYRIA.

and amaze the world with their grandeur—and she has lived to see them desolate, deserted and given over to the owls and bats. She saw the Israelitish empire exalted and she saw it annihilated. She saw Greece rise and flourish two thousand years and die. In her old age she saw Rome built; she saw it overshadow the world with its power; she saw it perish. The few hundred years of the Genoese and Venetian might and splendor were, to grave old Damascus, only a trifling scintillation hardly worth remembering. Damascus has seen all that has ever occurred on earth, and still she lives. She has looked on the dry bones of a thousand empires and will see the tombs of a thousand more before she dies. Though another claims the name, old Damascus is by right the Eternal City."

Shop Kinks.

The expression "shop kinks," as generally understood, includes all sorts of expedients and methods of doing work which are novel, ingenious or direct in their application to the work of railway repairs. It takes in the shop where engines are built or the roundhouse where repairs are made either temporarily or for keeps. It is also applicable to the car shop and to the cripple track where home and foreign cars go through the mill.

We have frequently noticed in railroad shops cleverly designed devices, with the evidences of home manufacture clearly stamped upon them, which might most truthfully be described as good shop kinks, and yet many of these have never been illustrated or described in the pages of any technical magazine, and the reason is not far to seek.

The designer of a home-made shop tool usually has no blue print to show for his work, the only record being often a rough sketch on coarse brown paper with a certain amount taken for granted and given to the handy man by his foreman as his authority to go ahead.

It is these very shop kinks which Railway and Locomotive Engineering is most anxious to be given the privilege of illustrating and publishing, and our friends and readers are invited to send us the details of such devices. It does not matter to the reading public whether such and such a shop kink or shop appliance is old as far as the originating shop is concerned. If it is old to you, dear reader, you can be pretty certain it will be as new as fresh paint to some one else. We want you to let us have it for the benefit of the man who has not thought of it, or has not been able to work out the details.

If you have a good thing in use in your shop, send us the rough sketch and a few words of explanation and we will put it in the paper on the first opportunity. Remember, when writing to us, that it is a foregone conclusion that it will be new to some one who will be glad to hear about it. Do not take anything for granted, tell all you know about it and what it does. Our club raisers can help the good work along by either sending us shop kinks themselves or by getting some man who is interested in that sort of thing to write us about the device or the method of doing work which saves time. Readers, you have the floor!

John D. Rockefeller as a Worthy Example.

Certain publications have of late been relieving their native dulness by abusing John D. Rockefeller. It is as natural for them to do this as it is for a mangy cur to yelp at a high-blooded horse. Mr. Rockefeller has committed the unpardonable sin of acquiring great wealth, a thing that is never forgiven by the imbeciles who never reach beyond the art of spending. The vermin critics are unable to appreciate the glory of amassing a fortune by the sheer force of stupendous ability, far-reaching enterprise and untiring industry, that are conspicuous by absence in the habits of the rich man's detractors. The following true story will illustrate some characteristics of John D. Rockefeller that help to account for his success in business.

Only a few years ago, less than a decade, when Mr. Rockefeller had reached the zenith of success in business and money making, a young gentleman student was a visitor at the Rockefeller home. This youth had acquired shorthand and was in the habit of practicing it for making passing memoranda. Mr. Rockefeller noticed that one evening, and proceeded to inquire how much study and practice had been necessary to acquire the skill displayed. The information was imparted, and next day Mr. Rockefeller sent for a teacher and proceeded to learn stenography. He kept earnestly at the study and practice of the new art, and by degrees became sufficiently expert to take down a speech if necessary, but it has been used mostly for brief memoranda convenient as an aid to the memory.

To acquire shorthand writing is nothing particularly praiseworthy in a young person who takes it up as a business and expects to use the art as a help to future bread winning; but it is something very extraordinary in an old gentleman whose business responsibilities are stupendous. It is that kind of persistent industry that lifts the particularly successful man above the easy-going mediocrity. It was the same devotion to work that enabled Mr. Rockefeller to distance his competitors in the struggle for business supremacy.

How the Missouri Pacific Got Its Name.

The veteran Master Mechanic, Jacob Johann, now living in pleasant retirement at Springfield, Ill., was the means of giving the Missouri Pacific Railroad part of the name which it now bears. When the first sections of the road were built, it was called the Pacific Railroad, and it prospered fairly well under that name. The freight equipment was marked P. R. R., which did very well when the Pacific system was cut off by the Mississippi from eastern railroad connections, but when the St. Louis bridge was built, Pennsylvania Railroad freight cars began to find their way west of the big river, and trouble began. P. R. R. meant Pacific R. R. or Pennsylvania R. R., and it was difficult to distinguish which was which. After there had been a great deal of difficulty from this cause, Mr. Johann proposed that Mo. be put in front of the P. R. R. of his company's cars, and General Superintendent McKissock agreed to do so. For years the cars belonging to the Pacific R. R. were stenciled Mo. P. R. R. When reorganization took place under Jay Gould, the road was called Missouri Pacific.

Projected Railway Repair Plant.

Waycross, Ga., is to have a thoroughly modern locomotive repair plant, if the plans of the Atlantic Coast Line Railway go through to completion. Increased business is given as the reason this company contemplates the expenditure of about $400,000 for new shops. There is only one small shop at Waycross, belonging to the A. C. L., and this will be torn down to make way for more modern structures.

The new shops will be the largest on this system, and will be up to date in every particular. They will be run by electricity. It is at present proposed to handle only second division equipment at Waycross. The locomotive repair shop will be 170 x 312 ft. and will be equipped with heavy overhead cranes. The round house will be 55 x 260 ft., and there will be in connection with it a coal handling plant, oil house and two-story store. Boiler shop and smithy will measure 70 x 312 ft. and will contain all the machinery that goes to make these kind of shops efficient.

The coach repair shop will cover a space of 100 x 312 ft., and will have room for 12 coaches. The paint shop will be close by and will be larger, covering 170 x 312 ft. It will hold 30 coaches. Planing mill and foundry will be 70 x 125 ft. and 80 x 160 ft., respectively, and close by the pattern shop will be placed. A car repair yard capable of holding 150 freight cars will be the principal outdoor feature of the plant.

Notes on Cuba.

BY W. J. MORGAN.

Cuba, rightly named the "Pearl of the Antilles," is undoubtedly making giant strides towards a staple, prosperous and contented nation.

SAN CRISTOBAL STATION.

The past winter saw the tourist travel and immigration exceed all previous records. The month of January alone was noted for travel, as over seven thousand people entered the port of Havana, three thousand of those travelers being Americans, who journeyed to Cuba, some for health and recreation and others for investment purposes. All, without exception, praised the island and saw in it prospects for a bright future.

To the traveler the lack of good and reasonable-priced hotel accommodation was apparent, as the hotels of Havana were crowded to their doors and very ordinary accommodation commanded very high rates. This so appealed to the travelers that efforts were made to induce such men as Henry M. Flagler, Sir William Van Horne (who is at the head of the Cuban Railroad) and others to build more hotel accommodation in Havana. Some years ago Mr. Flagler made an offer for a piece of property, but when it was known that it was Mr. Flagler who wanted it, the price of the property bounded skyward, and that is probably one of the reasons that Havana to-day has not a really first-class mammoth hotel. Sir William Van Horne, it is said, has also gured on Havana property, with a view to having built a large hotel, and there is now an effort being made in Havana by two or three parties to erect hotels, as there is no doubt but what there is room for several. The present hotels in Havana are of the old Spanish type, and very little accommodation of a modern nature is found.

The hotel accommodation in the interior of the island is no better, and one of the revolutions in commercial Cuba in the near future will be the building by capitalists and others of suitable hotels throughout the island, as the influx of visitors and the winter traveler are crying aloud for such improvements.

EXCURSION TRAIN IN CUBA.

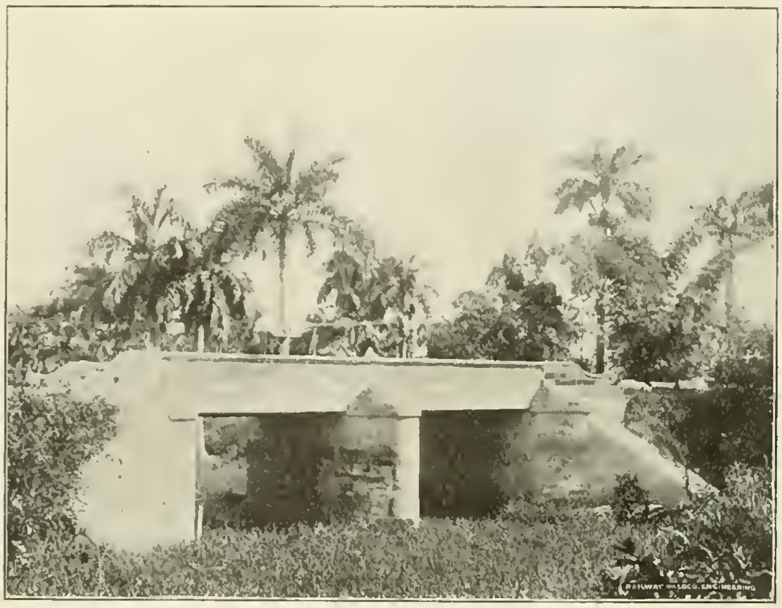
The government of Cuba, from President Palma down, is desirous of attracting the American traveler and American investors, and Mr. Palma, in conversation with the writer, declared that Americans would have the very best possible treatment at the hands of the Cuban government and people, as the people were not unmindful of the part the American nation took in their liberation. The government to that end is busily engaged in road building, and the roads constructed by the Cuban government were proved the past winter to be the best in the world, as an American automobilist made the mile world's record of 45 sec. on a Cuban road. This feat was accomplished by Mr. H. W. Fletcher during the automobile races on the road between Havana and San Cristobal, the previous mile record being 46 sec. made on a road in France.

These roads, constructed by the Cuban government under the control of the Minister of the Public Works Diaz, are not wide, being about 20 to 30 ft. in width, but the surface is hard and smooth, being constructed for the most part of limestone rock which, when thoroughly pulverized and rolled, makes an ideal mortar-like surface. These roads are being constructed in many parts of Cuba, and the roads leading out of Havana have received careful attention at the hands of the government.

A journey from Havana to the extreme point of Pinar del Rio province can be made for the most part by good roads, but the Western Railway of Havana has a well-equipped railroad running from Havana to San Juan y Martinez, its present length being 125 miles, and this road has now under consideration the extension of this line to

Guane, a further distance of approximately 30 miles, which will open up a very rich tobacco district.

This road is owned by an English company and is well equipped with modern rolling stock, its stations, bridges, freight and passenger cars being of good pattern and substantial. The new stations erected by this road will compare favorably with most railroad stations of the way station order in any part of the United States.



CUBAN RAILWAY BRIDGE.

The freight and passenger rolling stock, with the exception of some steel flat cars (which were obtained in England), are American or were constructed in the company's own shops in Havana with American material.

The cars are of the American type, and the capacity of the freight cars varies from 10 to 25 tons. The locomotive equipment is thoroughly American, the engines being of the Baldwin & Rogers' makes. New 80-lb. section rails have recently been laid for a considerable distance on the Western Railway road, and a great portion of the line is rock ballasted.

The main traffic in freight consists of tobacco, tobacco seedlings, sugar cane, sugar, timber, fertilizers, construction materials, animals, foodstuffs and fruits of all classes, the passenger traffic accounts for about one-third of the company's business. The line traverses the two most tobacco-producing districts in the world. The remarkable fertility of the soil through which this railroad passes cannot possibly be equaled in any part of the world.

Americans are rapidly taking up land in Cuba, and especially in this tobacco, sugar cane and fruit-growing district.

The royal palma tree is quite a source of revenue to land owners, each tree being worth to its owner a fixed sum each year, as the palm leaf is largely used for thatching and other purposes. The royal palma furnishes a berry, or nut, that seems to fall nearly all the year round, and it is picked up by the hogs, and they receive little or no food outside of it. A young man formerly of Iowa raised 1,000 hogs last year at no expense to himself, as the abundance of these nuts and other roots and grasses kept the hogs in good condition, and the abundance of spring water is found nearly all over the district. Stock farms are being started in many places.

CUBAN VILLAGE.

The rainy season is the only drawback to an otherwise perfect stock-raising climate in Cuba, and that does not seem to effect the stock to any great extent.

Truck farmers are taking up land within 100 miles of Havana, and this class of produce is being hauled to Havana for both consumption and export. The duty and some delay in shipment is the only drawback to an otherwise profitable line of Cuban business. The Government Agricultural Experimental Station is situated on the Western Railway of Havana and about 200 yards from one of the company's depots at Santiago de las Vegas.

Cuba is immune from frost, the lowest temperature recorded being about 50 degrees Fahrenheit. The past winter, when the thermometer went down to 50 degrees, the Cubans commenced to wear blankets, as the least cold is felt by them very keenly, but, at the same time the United States and Canada were endeavoring to keep warm with a 20 degree below zero temperature.

Orange growing and the production of other citrus fruits is being boomed in Cuba, as large land companies are selling land and planting a crop for prospective settlers, and the entire absence of frost is one of the inducements that is held out to prospective Cuban investors.

The price of land has jumped tremendously during the past two years. Formerly land that was bought from one dollar to five dollars per acre just after the war, cannot be bought now for less than ten to twenty dollars per acre. The Western Railway of Havana are using a paternal attitude towards prospective settlers, as they agree to convey bona fide settlers, their families and household effects from Havana to the station nearest to their property free of all cost, and this has induced many to take advantage of a Cuban investment. The company has also made a specially low rate on all classes of fruit and vegetable traffic to Havana from the interior, which enables the grower to place his produce on the

LOADING SUGAR CANE.

wharf at Havana at about 10 cents per crate of 80 pounds, at an average of 100 miles hauled. This rate, taking in consideration conditions in the island, is thought to be very reasonable.

The officers of this particular railroad, like those of the Cuban Railroad, are English people, the general manager being A. P. Livesey, of London, who is unremitting in his attentions to travelers and the company's interests. Don Diego Urra is traffic manager, being the only native in the management, as E. E. Coombe, resident engineer; C. C. Vernet, superintendent; H. L. Ashley, accountant, and S. T. Harris-Smith, secretary of administration, are, with the exception of the second-named, all Londoners.

One of the many sights seen on this railroad is the tobacco plantations on either side of the road, these being flanked by banana groves and sugar cane fields. The cane is brought from the fields by oxen team and then shipped to the nearest mill for grinding and from there in turn shipped by the railroad to Havana for shipment to the United States. The patient oxen are the beasts of burden as far as the agricultural side of the Cuban freight is concerned; they draw tremendous loads, and their slowness is made up by the certainty with which they pull the big-wheeled wagons over the country trails.

The soil is, for the most part, a black rich loom, and the decayed vegetation of years seems to have so enriched the soil that almost anything can be grown in Cuba, with the exception of certain cereals, the climate being too warm for them.

They still plow in Cuba with antique implements drawn by oxen, but the modern plow is making its way in Cuba, and some of the more progressive agriculturists are using the gang plow,

RURAL CUBA.

some of them using a gasoline motor for power. There is a law in Cuba against cutting down palm trees, and that, to some extent, retarded the development of farm lands. It would be a pity to see the palm trees disappear, as their ostrich-like plumes with which the landscape is dotted is one of the most beautiful sights imaginable.

The people, for the most part, live in fairly good houses, but there are many of the poorer classes that live in the well-known palm thatched houses for which the Cuban peasant is noted.

Railroading in Cuba is bound to take a large forward step in the near future, although it cannot be said that the railroads up to now have been profitable, as so much construction work and a large outlay in Cuba had to be made. Those who have studied the island believe, however, that railroad property in Cuba will pay handsomely in the very near future, as the island is being settled by good immigration very rapidly, and the railroads must necessarily bring their produce to the various ports for shipment.

Bracket Arch Cast Iron Car Wheel.

This is a newly patented wheel in which there is no ring core nor double plate around the hub. This allows the wheel to be thoroughly inspected and makes it absolutely safe, as any defect could be readily detected. The large amount of gray metal over the flange adds additional strength and absorbs and conducts the heat from the flange caused by brakage and friction of flange against the rail. The arch plate and heavy fillet over the flange prevents the development of seams in the throat of flange, so often met with in the double plate wheels in general use under modern heavy cars. As these wheels take but half the time in pouring that the double plate wheel requires, it has better chill, the metal is more regular in grain and the wheel is much stronger. According to the M. C. B. drop and thermal tests this wheel is from 25 to 30 per cent. stronger than the double plate wheel of the same weight and of the same iron; 700 lb. wheels of this type are in service

BETWEEN TOWN AND COUNTRY IN CUBA.

under 100,000 lbs. capacity cars on two of the principal railroad systems in the country. The wheel is patented by D. P. Rennie, Louisville, Ky.

How Paddy Holland Came Near Being Hanged.

BY SHANDY MAGUIRE.

It isn't necessary to tell an old-timer how railroading has changed in every particular in a decade, for he knows it; but to those who have been recruited later, it is only necessary for them to read the emanations of those who, like myself, are making mention of the changes which we have experienced, to learn a thing or two. Everything now goes by statistical accuracy—on paper—and the footings of the figures are all that the heads of departments look at. The omnipresent train-mile is set against the earnings, and if the showing is not on the right side of the column, somebody must stand from under. Every official must run his side of the job carefully, impressing upon his subordinates the utmost care and economy. Perhaps there is no one place watched with more zealous eyes, to get a crack at things, than is the monthly requisition. There is the place where the fine ungloved hand of the blue-penciler gets in its work. The foreman of a terminal roundhouse, away from the shops, will keep a close tab on his supplies. On the stated day, off goes his requisition to the M. M. It was pruned down to the starvation limit before he sent it. The M. M. gave it a friendly crack also before sending it to the Superintendent M. P. and M. It got another slugging from the last named gentleman, but when it leaves the Supply Agent, its own father would be ignorant of kinship; then comes the General Storekeeper, the wisest man of them all—in his own opinion—who claims to know how much material to send out, so, when the "goods" come to the foreman, they bear as much resemblance to the quality or quantity ordered as a pig does to Mary's little lamb.

Not many months ago, Terry Bennett, the roundhouse foreman, went through the formalities of making known his wants to his superior on the requisition blanks. He was as careful as he possibly could be, in order to avoid any reprimand for asking too much. It was all right for him to hug anguish to his heart, both in bed and out of it, because he was having engine failures on account of lack of material to keep them up; but he knew that when the letters got to him telling about these failures, and requesting him to "please advise," that if he would honestly reply, "I had nothing to make proper repairs because you cut down my requisition," he would be up against a superior power, so he decided to continue hugging and to keep cut out everything he supposed he could get along without. In an instance I am about to relate, the spirit of economy came near costing Bennett and his superiors a trial at bar, on the charge of attempted manslaughter, if a jury so decided, and if said jury chanced to be some of the "horny-handed, honest-fisted, tillers of the soil," as they generally are, we all know what the verdict would have been.

Bennett had a few engines of the culm-burning type, or, more familiarly known as "Mother Hubbards," coming and going daily from his roundhouse. Tom Crosby, the engineer of one of these engines, reported one morning, after making his trip on the night line, that his speaking tube was all rotted away, and that it was almost impossible to get into communication with his fireman. Bennett replied he would order the tubing on the next requisition, and also added: "Tom, fix some kind of a dingis to attract Paddy's attention until it gets here, if it ever does come." Tom did as he was told. He got a piece of bell rope and made one end of it fast to the top of his reverse lever just under the thumb latch,

FIELD OF SPROUTING TOBACCO, THE POT BOILING CROP OF CUBA.

and led the other end into the back cab, where, with an eye bolt and an old tin pan, he improvised a gong, to attract the attention of Paddy when he'd need him. Nearly everyone is aware that the Mother Hubbards have the front cab very near the smoke stack; behind it is a neatly sloped Russia iron jacket covering the fire box, which extends over the driving wheel on each side and runs back to the back cab, where the fireman does be generally domiciled. The jacketing slopes down from the center of the engine to the extreme width of the fire box on each side, where there is a gangway leading from the back door of the front cab to the front door of the "back cab," with a railing of 1½ in. pipe on the outside to keep a man from falling off. This leaves a space of about 20 ft. dividing engineer and fireman; so it can be seen how necessary the speaking tube was, which should be always in good condition. It is but a few years ago that a bill was introduced in the Legislature of the State of New York that an extra or third man was a necessity on a locomotive of this type to sit in the cab with the engineer, so as to be there is case of sudden death or disablement; but it did not pass. It was opposed by the engineers, feeling that it would divide authority.

The pay day after Tom Crosby reported the defective tube, Paddy Holland, his fireman, hoisted in quite a jag, which was unusual with him. True, he loved a schooner or two of beer, but very rarely exceeded the bounds of propriety. He was a sailor in his teens, having run away from home to live "a life on the ocean wave," caused by reading tales of the sea; but he only made a few voyages, and he was glad to be a landsman again. He was strongly influenced by the brief education he received on shipboard, and he used the slang picked up there very frequently. He was as homely as a scarecrow, and as good natured as homely, and a modern Hercules in strength, and largely sought for by the engineers, but he stuck to Tom Crosby "like tar to a new coat," as he expressed it. "'Tis true I like to pilot a couple of schooners across the bar, but I let the others remain outside until I have plenty of harbor room," he told the M. M. in his nautical phraseology in rely to the question "if he was a teetotaler."

His best girl and himself never hitched for twenty-four hours at a time without having a snarl, and on this day in question they had a set-to more prolonged and vicious than usual, she getting in the parting shot by telling him he was so homely that he'd stop a clock or disarrange Crosby's watch, and ought to be laid off. Like many a victim of woman's witcheries, he filled up before going out, but he was unnoticed by anybody. He performed his duty in a thorough manner, keeping pointer and pop up all the time, and when he stopped at Earlington he "freshened the nip," thinking Kittie was looking at him, and he spiting her.

When the train got well in motion again, he came out of his hole for a breathing spell and stood upon the gang plank with his hands on the railing, looking into the night and fancying he was commanding a ship at sea. "How does she head?" he shouted in the direction of the front cab, and in reply to an imaginary answer, he said, "Keep her away two points; so! steady as you go." The pointer was going also—back, and the old tin pan was beating the signal to keep her hot, which made him adjourn from the bridge for a trick in the coal hole.

It did not take him long to get her hot again. She was a good steamer old tin can. He yanked and yanked, but got no response. Fred Hart was deadheading home in the left side of the cab, and Crosby, in desperation, begged of him to go back and find Paddy. Hart went. He found him sleeping the sleep of innocence on the slope of the coal, his head about two feet higher than his heels, and the rope around his arm. He let a shout at him, so as to make him jump, for Hart was a trickster with a record; but Paddy slumbered on. Hart made no more noise. He ran the rake through the fire and closed the door; then he gave his undivided attention to Paddy. He took the rope from off his arm, cleared it up, made a hangman's knot in it, greased the running part, shoving the knot as close to his ear as Jack Ketch could do it, taking up all the slack. He then reported back to Crosby that Paddy was asleep, but that he—Hart—woke him up.

CUBAN HIGHWAY. GOOD AUTOMOBILE RACING ROAD. FEW PEOPLE TO KILL BESIDES THE RACERS.

and, fortunately for Crosby, she was; for, on this particular night, Paddy was much more than half-seas over.

They were approaching Bailey's hill, which meant a down-grade of 27 miles to them going out. The moment Paddy felt her shut off and going down Bailey's, he prepared for a half hour's sleep. He set the furnace door, took the rope from off the old tin pan and then he passed a turn of it around his arm; but, unfortunately for him, he fouled it between his arm and Crosby, by having a turn of it around the tender brake staff, and Crosby might pull until he'd part the rope without getting him at attention. At the foot of Bailey's was a sharp piece of grade, which the engines never approached without being in perfect order to make it, having such a long down grade to get ready. The pointer went back to 110 before Crosby tackled the and he was again attending to biz. Crosby was mad. He said to Hart: "I wish pay day for that lad would come but once a year. He never takes a drink but with the gang; then he goes to see Kit Johnson, and when she gets the smell of it, the racket begins, and he fills all the way up for spite. Look at the pointer where it is now!" They were within a mile of the station, and in few seconds Tom shut off; at the same time he unnotched the reverse lever, and threw it down the quadrant till it fetched up with a bang in the corner. The moment he made the stop, not hearing the blower on, he made a jump for the back cab; the sight he saw froze the blood in his veins. There was Paddy with his head yanked up against the back boiler head, browning away; his two eyes out upon his face in sightless condition, and a strangling gulp growing fainter and fainter coming out of his throat. He had one arm protecting his face from the boiler, and with the other hand he was feebly trying to loose the rope. As soon as Crosby could steady his own nerves he cut the rope, and poor Paddy fell as limp into the tank as any gallows bird ever did after being cut down. When Crosby did not go ahead on signal the train crew came to find the reason for delay. Willing hands lifted Paddy out, and did everything to resuscitate him, with poor effect. When a glass of brandy failed to be swallowed, the conductor ordered the station agent to have him taken to the hospital. Hart volunteered to fire in, and so they started. When Crosby arrived, all sorts of rumors were ahead of him, one worse than another, and the whole of them having Paddy dead, from being lynched by some persons unknown. Kit Johnson was nearly crazy, and took the next train to Plainville, where she helped to nurse Paddy back to life and health. After a few days he could faintly whisper, and the first words Kit heard him utter were these: "I suppose, Kit, you'll never look at me again. You told me a few days ago I was homely enough to stop a clock, but look at me now, with the big burn on my cheek."

"Paddy, darling, you were always handsome to me, but woman-like, I did not want to tell you so. You have only one fault, and that is, you love the budge better than you do me. Stop that, and you'll be one of the biggest, best-natured and most beautiful boys on the road."

"Will you consent to us getting married before I report for duty again?"

"Yes, Paddy, if you promise me you will drink no more."

"From this moment, Kit, until I die, a drop of the damned stuff will never cross my lips."

They were "spliced," as Paddy expressed it, soon after. He got his time while he was off. The hanging was hushed. The speaking tube was renewed, but the requisitions are getting slaughtered just the same.

Early Locomotive Contest in Canada.

An interesting bit of railroad history has been recalled by the death in Kansas City, Mo., of W. T. Huckett. He was the man who brought the first locomotive to that place. Previous to that he brought the first locomotive to Toronto, Canada. In 1851, a small road known as the Ontario, Simcoe & Huron was built, and those in charge were not particularly in favor of engines built on this side of the line, but it was nevertheless determined to give a fair trial to engines from England and the United States before the road was fully equipped.

Engines built in both countries were prepared for the test, and Mr. Huckett was given the task of taking across the lake an engine built in this country. This engine was named the "Lady Elgin," as a compliment to the wife of the Governor-General of Canada, and a speed competition took place between Mr. Huckett's machine and an English engine named the "Josephine."

It appears that in this contest the "Lady Elgin" had the lead, but while making a stop for water the "Josephine" caught up with and passed her rival. The result was that engines of English manufacture had the preference on the O., S. & H.

In commenting on this incident, the Toronto *World* says that there must have been two engines named "Lady Elgin." One of them was the engine which Mr. Huckett brought into Canada and the other was the first locomotive imported from England by the Grand Trunk Railway. This latter engine is described as being a small machine with a straight smoke stack and a shrill whistle, both of which were decidedly English characteristics.

The Grand Trunk "Lady Elgin" began work near Quebec, on the Point Levis side of the St. Lawrence, where the Quebec and Richmond section of the road began. This "Lady Elgin," however, eventually moved west with the construction of the line from Lower to Upper Canada, and when too far away from the coal supply was changed to a wood burner. This reconstruction probably took place in the machine shop of James Good, in Toronto.

Attempts to Effect Artificial Life.

A question that has always appealed keenly to reasoning and observing man is, what is life? Ever since the birth of science speculations have been rife as to the origin of life, and no end of theories have been advanced as to how life may have originated outside of the orthodox way of Divine power of creation.

Professor Loeb, of Chicago University, has been conducting researches concerning the production of life through certain chemical combinations, and he says: "It is now proved beyond all doubt that the variables in the chemical processes in living organisms are identified with those with which the chemist has to deal in the laboratory." We scarcely share the hope cherished by this man of science. It is like bringing into contact certain compounds that under required conditions will produce an explosion. The spark of high temperature which induces chemical combination being absent, the mixture remains inert.

Dr. F. J. Allen, a noted chemist and biologist, of Cambridge, England, believes that the vital spark will be produced by artificial means, and outlines the combinations by which living cells may be produced in the laboratory. One of Dr. Allen's theories is that cells of vital life may be produced by the deoxidation of compounds containing nitrogen, oxygen, carbon and hydrogen by the action of light, heat and electricity, the only thing now wanting being the proper conditions and exact quantities for combination.

These theories are exciting great interest in the scientific world and deserve the attention of all thoughtful people.

Eluding the Steel Trust's Tariff.

A Philadelphia company has recently placed an order in England for 30,000 tons of pig iron, which it will convert into steel rails in this country and export to South America. As the pig iron comes in practically free of duty, the company receiving a drawback of 99 per cent. of duties paid upon the export of the rails, the railroads of South America are thus able to take advantage of the cheap raw material of England in this indirect manner. The railroads of the United States cannot do this, however, as the pig iron would have to pay a stiff duty if intended for domestic consumption, and they must pay the $28 per ton demanded by the steel rail pool. This is one of those beauties of the protective tariff system that are continually cropping out. If American railmakers can, in open competition with those of England, buy their raw material in that country, pay the ocean freight to America, manufacture the rails here, pay the added freight on the finished product to South America, and do all this at a profit, underbidding the English manufacturer, their profits on their sales to American roads must be very gratifying to their stockholders.—Phila. *Record.*

D. & H. Annual Report.

At a recent meeting of the directors of the Delaware & Hudson Railroad the seventy-fifth annual report was presented. The net income of $4,452,521.96 was shown, which is 11.6 per cent. of the capital stock. The new equipment added within the year covered by the report was 50 locomotives, 20 passenger coaches, 3 café cars, 1 baggage car, 2 combination, 100 flat cars, 50 coal cars and 6 milk cars. A very gratifying feature which was brought out in the report was that not a passenger has been killed on this road for the past ten years. This is a record which the railroad officials may well be proud of, and if the same could be truthfully said of all roads in the United States this would be by all odds the safest country in the world for railroad travel.

To surround anything, however monstrous or ridiculous, with an air of mystery, is to invest it with a secret charm and power of attraction which to the crowd is irresistible.

General Correspondence.

Handling Trains Round Curves.

Editor:

Referring to the question of the safest way to handle a heavy, fast passenger train on a curvey railroad, with a heavy type modern locomotive, it is a dangerous practice when the speed of the train is 25 miles per hour and up to 50 miles per hour to alow it to enter—say 7 to 10 degree curve—without reducing the speed to a safe limit. This must be judged by the engineer in charge, and about the only way judgment of this character can be obtained is to acquire it from practical handling of the engine and train. Of course, the condition of the curve to be rounded must be considered as to whether it is flat or elevated. It has been proved that it is more dangerous to round a flat curve than one properly elevated. When freight and passenger trains use the same track it is sometimes necessary to sacrifice some of the elevation to better enable the long heavy freight train to get around it without stalling.

The question resolves itself into the safest method of getting the fast moving passenger or express train over the curvey road with one of the heavy modern locomotives and avoid a possible derailment and at the same time have the train run smoothly, giving to the passengers the satisfied feeling that there is no present danger.

The careful engineer has his mind on his work, he is familiar with every curve on his division, he has a satisfied feeling and is confident that he knows about the speed of his train, no matter whether he is running over the road day or night. every landmark is as familiar to him as the gauge cocks on the boiler. He realizes from the swaying of his engine about how fast it is safe to allow her to enter the curve. The curve may be 7, 8 or 10 degrees—it matters not, his judgment tells him how much he must reduce the speed and get around the curve in safety—this judgment has been developed by years of practice—he is approaching a curve—say, 9 degrees, at about 50 miles an hour, he feels assured that it would be criminal carelessness to allow the train to enter it at that velocity and assume the third risk in ten of coming out at the other end in safety. His better judgment—the golden fruit of experience—tells him to apply the air brake with the necessary reduction while the engine and train is yet on the tangent, thereby reducing the speed to a safe limit and just as the engine enters the point of the curve he releases his brake, and if the curve is a long one and the engine is liable to pick up the speed of the train to the danger limit again he laps the valve and as the engine and train is about to come out on the tangent he draws off 7 or 8 lbs., just enough to prevent the disagreeable side lurch that is always encountered when a train leaves a curve for a straight line. The brake is then released and the system pumped up, so as to be ready for the next kink in the line. It is not necessary to close the throttle in this transaction, nor does the up-to-date engineer do so, he allows the engine to continue using steam, as though it was his intention to go somewhere.

VICTORIA JUBILEE BRIDGE OVER THE ST. LAWRENCE RIVER ON THE GRAND TRUNK SYSTEM AT MONTREAL.

We have noticed that some engineers on approaching a curve (if it was sharp enough to cause him a little uneasiness as to safety in getting round it) close off the throttle and allow the train to drift into and around the curve—perhaps the fireman had just finished putting in a fire of "green" coal—the smoke settles down and works its way into the coaches among the passengers and is termed by them a nuisance that should not be tolerated. However, even though the throttle has been closed, as just mentioned, its object has not been obtained, it was the evident intention of the engineer to avoid a disagreeable side lurch. But in this he is laboring under a false impression. It should be plain to him that the speed of the train has not been sufficiently reduced to accomplish this, and in addition to the side lurch the train is badly smoked, causing perhaps annoyance to the passengers. The comfort and convenience of the passengers should always be kept in mind by the engine crew. The engineer should endeavor to keep the train running as smoothly as he can, and the fireman should be on the alert and avoid smoking the train at the necessary shutting off places. The passengers will make complimentary remarks about the smooth and clean ride they enjoyed while a passenger on your train, the road gets a reputation that is appreciated by all, and about as good a thing as any in connection with the whole affair, the employers are not grieved that they have you on the list as competent employees—your careful attention to duty—your intelligence and ability will in due course merit ample reward.

To go a little further with this subject in order to be perfectly plain, I have no hesitancy in offering the following recommendations. The writer has had the advantage of several years of experience handling a heavy modern passenger engine drawing a heavy train on a curvey road. They are, however, opinions, and opinions are similar to beliefs, they prove nothing except the honesty of those holding them and the good results accruing therefrom.

I have found it an extremely safe practice when the train was running at a high rate of speed that if the curvature was heavy and the brake applied with sufficient force while the train was yet on the tangent, to bring it to a safe rate of speed and released just as the engine was about to enter the curve, and if the curve was a long one and the speed increased to what might be considered hazardous, the brake valve brought to the lap position and allowed to remain there until the engine was about to come out onto the tangent, when a sufficient reduction would again be made to prevent a heavy side lurch, this point passed, the brake is released, the valve placed in running position and the system pumped up and made ready for the next requirement, etc. This practice was the most productive of smooth riding, the abatement of the smoke nuisance—the throttle being kept open—and reduced to a minimum the possibilities of derailmen.

On the other hand, it is considered dangerous practice to allow a fast moving passenger or express train to enter a curve and not reduce the speed until the engine begins to roll and sway, when in all probabilities the brakes will be applied many and ofttimes very heavily, in order to have her "right herself." This practice is doubly dangerous, due to the fact that when a brake is applied heavily additional weight is thereby thrown against the rails, the engine truck-drivers and coach trucks are held more rigidly in the graps of the tightly applied brake and are not free to adjust themselves to the curvature. The dangerous features are more highly developed in the engine than in any of the rest of the train, due to brake hangers being suspended from the engine frame rendering them very rigid. This is a point that should always be borne in mind by the engineer.

Another important point to be kept in mind by the engineer is whether his engine is provided with a rigid trailing truck or a radial swing truck. The former wears lateral motion in them and when it is plentiful the engine sways from side to side, rounding a curve at a high rate of speed, and if the speed is not kept in check either the engine truck or the trailing truck is liable to be swung from the rails and a catastrophe may be the result. In this will be found another good reason why speed should be reduced before entering the curve. It is a duty devolving upon the locomotive engineer to adopt every precaution for the safety of his engine and train, his own life and the lives of the traveling public.

Bradford, Pa. JAS. SPELLEN.

Engineer and Engine Driver.

Editor:

Your remarks anent Engineer and Engine Driver.

There is no question but that I am one of many who thoroughly agree with you as to the proper name for the man who runs a locomotive. He is most emphatically an engineer, first and last.

There are many in this world to-day occupying railroad and other positions that would wish and do decry vocations that they themselves could not or would not attempt to fill. There are also many afflicted with the disease of anglophobia, making them anglomaniacs—engine driver is one of the signs.

Is a marine engineer or stationary engineer a marine engine driver or runner, a stationary engine driver or runner, or do these self-appointed philologists exempt that branch of the profession?

There is a certain class ready to cry down any and everything that tends to give one a standing among his or her fellowmen and women.

One of many regrets is the tendency of railroad managers not to promote locomotive engineers to positions in the operating department so much as those in other departments.

I refer to promotion to trainmaster and up the line.

I may be wrong about this, but in my limited area for information it seems as if locomotive engineers did not get into the operating department very often compared to others.

One word more, as the minister says—I wish to express my gratification at your starting a correspondence course or school. If the readers will take interest enough to follow it up the results will be most beneficial.

Glenns Ferry, Idaho. A. S. ERSKINE.

Train Resistances.

Editor:

"What is the tractive power of a locomotive, and how is it calculated?" have been asked and answered so frequently in the columns of your paper that one is led to imagine that this problem is the Shibboleth of the locomotive engineer. And yet when this problem is once solved for any given locomotive, the tractive power so obtained remains a fixed quantity as applied to that engine, or at most varies only with the steam pressure.

There is another problem, however, to which scarcely any reference is made, and which is, it appears to me, of almost greater importance, and that is the question of train resistances. These resistances, which must be overcome, are mainly three, namely, hauling at a given required speed, the load to be hauled and the grades to be ascended. In solving the problem of train resistance it is therefore necessary to ascertain the force required to move a train under these three conditions, and this must be frequently done in order to judge whether engine No. So-and-So can do the work or not, as this force, or the sum of these resistances must not on any account exceed the effective draw bar pull of the engine selected for the job. It will thus be seen that there is a very close connection between locomotive tractive power and train resistance, and it would seem as though the latter problem would have to be solved very much oftener than the former one.

The calculations required for ascertaining the draw bar pull of an engine have been set before your readers so frequently that I will not repeat them. The formula by means of which the train resistances are ascertained is generally the following one:

$$R = \frac{T}{2000}\left(\frac{v+8}{4} + 0.38g\right)$$

where
R = total resistance in tons,
T = total load in tons of 2,000 pounds to be hauled, including the locomotive and tender,
v = speed of train in miles per hour,
g = grade in feet per mile.

Assuming that the effective draw bar pull of a locomotive and the train resistances to be overcome are equivalent, we obtain by inversion of the above formula the total load which a locomotive of an already ascertained draw bar pull can haul at a given required speed and up a given grade, thus,

$$T = \frac{2000\ R}{\left(\frac{v+8}{4}\right) + 0.38g}$$

in which R is the known effective draw bar pull of any given engine in tons.

Of course it would not be wise to select for any given run an engine whose draw bar pull is the equivalent of the train resistances enumerated; some margin must be allowed for to provide against contingencies and the unexpected. Experience and good judgment will suggest what is proper.

The resistances above named are, as I have stated, the main ones encountered; others which have more or less effect are curves, wind force, condition of track, etc., which will be covered by the margin of allowance above named.

Example.—Required to find the total resistance, the load being 400 tons, the speed 50 miles an hour, and the steepest grade 50 ft. per mile.

$$\text{Resistance} = \frac{400}{2000}\left(\frac{50+8}{4} + 50 \times 0.38\right)$$
$$= \frac{1}{5}\left(14.5 + 19\right) = \frac{33.5}{5}$$
$$= 6.7 \text{ tons total resistance.}$$

Example.—How many tons can be hauled by an engine whose known effective draw bar pull is 12 tons (24,000 pounds), the speed to be 40 miles and the steepest grade 100 ft.?

$$\text{Total load} = \frac{2000 \times 12}{\left(\frac{40+8}{4}\right) + \left(100 \times 0.38\right)}$$
$$= \frac{24000}{12+38} = \frac{24000}{50}$$
$$= 480 \text{ tons, including engine and tender.}$$

A slight inspection of the above will

at once show how often the solution of similar problems may be required.

The simplest way of solving all these problems (tractive power and train resistance) and one which requires neither paper nor pencil, and yet is thoroughly accurate, is by means of the two handy Cox computers put on the market by your publishers. I have found them very useful, simple and reliable, and consider that they should be used together, as the problems they solve are so closely related to each other. NEMO.

Cleaning Glasses for Bullseye Lubricator.

Editor:

The cleaning and making fit for service again of Bullseye Lubricator Glasses has been a problem to contend with since the introduction of this style of lubricator. I give below a description of the method which has and will prove successful in overcoming this impediment to proper repairs.

The face of the glass (not the whole glass) to be cleaned should be dipped and held for about two minutes, in a solution of hydrofluoric acid and water, equal parts, then rinsed off and ground on fine grindstone, holding face of glass squarely against stone until a perfectly level surface is obtained, then the glass should be buffed on smooth emery or crocus buffer.

This operation will again make the glass as clear as one which has never been in service. Should a higher polish be desired, the face of the glass can be rubbed with a small amount of jewelers' rouge. E. A. PALMER.

Bloomington, Ill.

Engine Truck Hub Liner.

This sketch illustrates an economical and efficient engine truck hub liner—one which will give longer and better service than the babbit liner and one much cheaper to apply and maintain than the brass liner poured into the hub of the wheel.

It is of cast brass one-half inch thick with shape to correspond with shape of face of box. At the lower ends a lug or projection ⅜ in. thick is cast, which sets into a slotted depression of box to assist in holding liner in position. Two ⅞ in. countersunk head screws about one and one-half ins. long over all complete the fastening. The heads of screws are made small enough to allow them to sink into liner about ⅛ in. below its surface. If there is any doubt about the screws remaining tight, a center punch mark in two or three places around edge of head will keep them from turning.

About 80,000 to 120,000 miles can be had by the use of this liner and still leave face of box in suitable condition to apply another one. The Erie Railway have used this style liner for several years, obtaining very satisfactory results. E. O. PALMER.

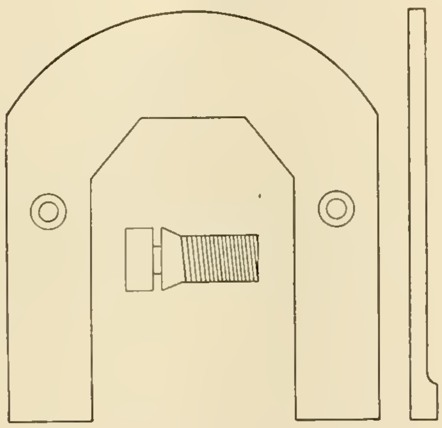
Bloomington, Ill.

Observations on the Locomotive Front-End.

Editor:

The most accurate, reliable and comprehensive data on the form, density and efficiency of the exhaust jet is contained in the 1896 report of a committee of the American Railway Master Mechanics' Association, under the chairmanship of Robert Quayle, of the Chicago & North-Western Ry. The matter in this letter referring to the exhaust jet, especially the measurements of vacuum and pressure in stack and front-end, is largely based on that report.

The cross-sectional form of the exhaust jet is influenced by the form and dimensions of the channel surrounding it, even though not in actual contact. It is supposed that, in the stack, the vacuum around the column of the exhaust tends to compact it and thus prevent contact with the stack until it reaches nearly to the top of the stack. Whether this is true or not, personal experiments indicate that when the surrounding channel is within a certain distance of a column of steam issuing from a nozzle, the jet is apparently attracted to and comes in actual contact with the enclosing channel. Accurate tests made by the Master Mechanics' Association committee show beyond question that the exhaust jet does not, and preferably should not, fill the stack at or near its base, but that it comes in contact with the stack only quite near the top. The foregoing facts should be remembered in connection with calculating the diameter of petticoat pipes. The plan of the angle of the exhaust jet is not like an inverted frustrum with sides of straight lines, as is commonly supposed. Its form, between the nozzle and its point of contact with the stack, is represented by two slightly concave curved lines. It is in actual contact with the stack only about 10 ins. or 12 ins.



ENGINE TRUCK HUB LINER.

Vacuum gauges (measured in inches of water) show that the vacuum between the wall of the stack and the column of the exhaust jet, at a point ⅓ of the length of the stack from its top, is 1.50. midway of its length it is 2.52, and at about 17 ins. from its base it is 3.61. At a point midway between the smoke box circumference and the nozzle, on a line with the center of the arch, the vacuum is 2.54 ins.

The pressures in the center of the exhaust jet are at about 12 ins. above the nozzle 59.3. 24 ins. above the nozzle 44.6, and about 16 ins. below the top of the arch 28.5. The gauge also showed that the pressure diminished rapidly as it was moved from the center toward the circumference of the jet, varying in velocity from 576 to 292 ft. per second. Increasing the number of pounds of steam exhausted per unit of time. or increasing the boiler pressure, increases the velocity and diminishes the spread of the jet, resulting in increasing the vacuum.

The direction of the gases in every part of the smoke box and stack is from the nozzle tip up toward the exhaust jet. and not directly toward the stack. The smoke box gases and sparks are slightly enfolded within. but largely entrained by the jet. The induced action of the jet is greatest and the intermixing or enfolding action least at the nozzle. It is believed that as the mixing action is increased. the induced action is diminished, with no resulting gain. and that, therefore, the more compact the jet the higher will be its net efficiency.

It is claimed that the efficiency of the jet is unchanged, providing the weight of steam exhausted per unit of time is equal. whether the engine is working at long cut-off with heavy impulses of the exhaust at long intervals or working at short cut-off with quicker or lighter impulses at shorter intervals. The nozzle diameter should be as great as affecting conditions will permit.

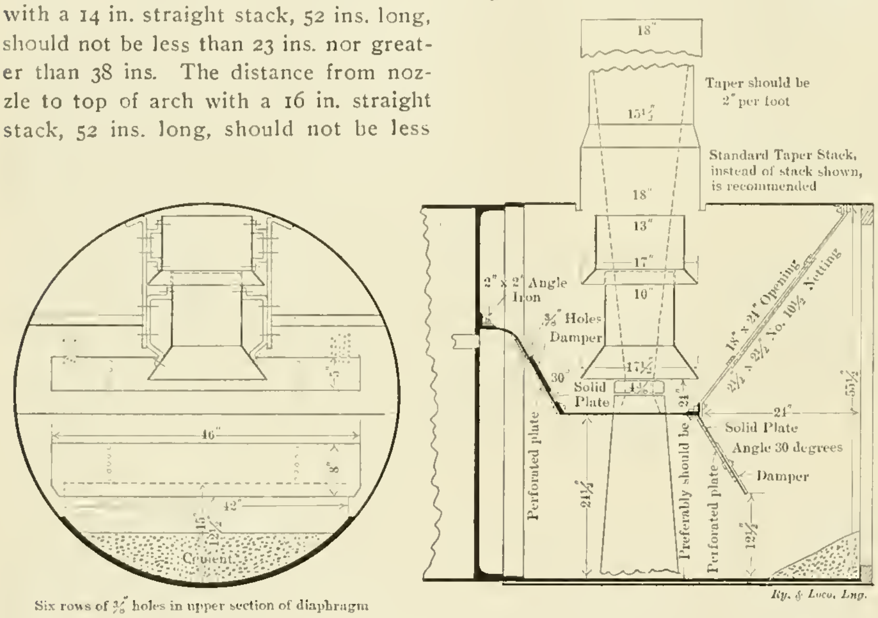
Increasing the rate of combustion by undue contraction of the nozzle or grate area results in considerable decrease in evaporation per pound of coal. This is due to back pressure in the cylinders and to excessive spark losses and incomplete combustion of the gases in the fire box. Increasing the rate of combustion per sq. ft. of grate surface per hour from 61.4 to 240.8 lbs., decreased the evaporative efficiency 19.2 per cent. and increased the pounds of sparks per hour from 46 to 160 lbs.

There is doubt as to whether a splitter in the nozzle is of any benefit under any possible conditions. However, apparently good results have been obtained by enlarging a nozzle equal to the cross-sectional area of a ¼ in. or ⅜ in. splitter, when such splitter was placed in the top of the nozzle at right angle to the partition in the exhaust stand. Any possible advantage of such a bridge would be its effectiveness in overcoming the form of the exhaust (in an exaggerated form represented by the shape of a figure 8), due to the action of the engine in exhausting somewhat from side to side instead of exactly vertical, this being due to the deflecting influence of the exhaust stand partition and the angle of the nozzle.

The most efficient form of exhaust nozzle is the single one, with its interior in the form of a frustrum of a cone, ending at the top end with a parallel cylinder 2 ins. long. The distance from the nozzle to choke of a 14 in. stack, 52 ins. long, on a 58 in. front-end, should not exceed 50 ins. or be less than 40 ins. for maximum efficiency. The distance from nozzle to top of smoke arch with a 14 in. straight stack, 52 ins. long, should not be less than 23 ins. nor greater than 38 ins. The distance from nozzle to top of arch with a 16 in. straight stack, 52 ins. long, should not be less than 28 ins., nor greater than 38 ins. The distance between nozzle and choke of stack should be slightly increased for the highest steam pressures.

The cross-sectional area of choke in each side of exhaust stands (when choked at all) should at least equal the area of the largest nozzle that may be applied. Bulged or pear-shaped stands are objectionable on account of interfering with the free passage of the gases from under the diaphragm damper. Stands should be not less than 19 ins. high. They should have a partition in them to prevent the exhaust from one side effecting back pressure in the other side of the engine, but such partition should not be less than 8 ins., nor more than 12 ins. high, and it should not extend a greater height than to a point 10 ins. from the top of the stand.

K. P. Alexander,
M. M., Ft. S. & W. Rd.
Ft. Smith, Ark.



Six rows of ⅜" holes in upper section of diaphragm

FORT SMITH & WESTERN FRONT END.

The Baggage Smasher's Art Exposed.

A very cleverly devised moving picture lately had quite a run at each of Mr. F. F. Proctor's four New York theaters. It was called "the history of a trunk." The opening scene showed a young lady packing her "Saratoga" for a trip to a fashionable seaside resort. She was visited by her lover just as she was about to close the lid, then the step of her irate parent was heard on the stair. The young man overtaken with consternation jumped into the trunk, squashing everything in it. The young lady hastily closed the lid and locked it up. The irate parent, annoyed at his daughter's delay, ordered the trunk to be taken out by two men who, on feeling its weight, demanded more pay.

The next scene showed the trunk slid down the stairs, flung on an express wagon and driven off to the station. Here it is thrown to the ground and dragged to the platform. In a moment the train comes in. The luckless trunk is hoisted up on end and shoved "aboard." When the train arrives at destination (the train photographs, we may say, are excellent) the trunk is thrown out, not lifted down, oh no! and while below the baggage car door it is used as a cushion for other and even heavier trunks to fall upon it as the car is unloaded. Here, therefore, the baggage smasher's art is exposed.

The trunk is next seen on an express wagon which is soon passed by another wagon owned by the same company. Some dispute about the trunk ensues among the drivers as it appears to be on the wrong wagon. It is, therefore, thrown off, not lifted down, mind you, and an endeavor to get it up to the top of a huge pile of trunks on the other wagon results in one or two falls after which it disappears around the corner.

When opened up, as it is in the last scene, the head of a disconsolate young man with disheveled hair, a black eye, a damaged nose and a general expression of "have-I-been-through-the-whirl-pool-rapids?" is shown to the delighted audience. The picture is lots of fun. The films were made on one of our large railways near this city by Paley and Steiner, of New York.

The fire department of the town of Clyde, N. Y., have a novel way of letting people know when a fire is raging. Instead of ringing a bell, the necessary sound for giving the alarm is made by striking a locomotive driving wheel tire. The tire is hung where it can be easily reached by any one desiring to call out the volunteer brigade. When struck it gives forth a very penetrating sound, like a huge gong. The tire is about 6 ft. in diameter, and weighs 680 lbs. The sound carries easily two miles, and means fire every time, as it cannot be mistaken for the sound of a bell.

The American Steel Foundries have been awarded a contract by the Norfolk & Western Railway Company for body and truck bolsters for 4,000 cars of different designs and capacities. These cars will be manufactured at the Roanoke shops of the railroad company, and by the various car builders. The bolsters for all of these cars will be made entirely of cast steel. Another large order has been received for cast steel body and truck bolsters for 2,000 Detroit Southern Railroad Company's cars. These cars will consist of 1,800 forty-ton gondolas, and 200 thirty-ton flat cars.

The Small Motor.

The small electric motor is becoming very popular. It not only has a field for itself in the railway repair and other shops, but it lends itself readily to temporary work such as the demonstrating of mechanical operations.

At all kinds of exhibitions such as that recently held in Washington in connection with the International Railway Congress, and at our Master Mechanics' and Master Car Builders' Association, the small motor is becoming more and more in evidence. It is easily applied, it can be set up on a shelf, or under a table or in any suitable position and with the aid of a short belt can be made to operate machinery, and, as we said before, demonstrate the action of any piece of mechanism.

The motor is compact and can be switched on and off in the shortest possible space of time, and when its temporary work is over it can be easily packed up and taken to new fields of activity. Verily the small motor has great possibilities.

New Passenger Car Lighting System.

While important improvements have been made in the devices for illuminating passenger cars during the past few years, there is a demand for more light, under economical conditions. The Pintsch Company has, after two years experimenting, placed in service a lamp of special design which brings into use a mantle of unique and original form or shape. This mantle is of an inverted type about 1 in. in diameter and is so arranged as to provide a suitable jet. The lamps are shown in our illustration as applied to a Pullman sleeping car and the mantles used give a soft white light, as they are inside of globes. The mantle and globe being fixed together, are fastened to the lamp proper by means of a screw socket and can be placed as readily as an incandescent lamp can be.

The results obtained may be appreciated when it is stated that the illumination given is 33 candles per foot of Pintsch gas used, or an efficiency of about three times that given by the present standard Pintsch lamp for the same consumption of gas. Actual service tests indicate the life of the mantle to be at least three months. The ease of renewing the mantles, the smokeless flame and the cleanliness of the whole arrangement are part of the advantages which are secured. Whatever there is of simplicity, efficiency and economy in the Pintsch system, are still retained when using this light. In cases where it is decided to adopt the new light an important saving would be made, because the lighting equipment where now used is still available, with small additional cost for renewing the lamp fixtures.

CEILING OF MODERN RAILWAY CAR WITH MODERN LIGHTING SYSTEM.

The working parts of the lamp are simple and compact, and the ornamental features are not thereby limited and, as the illustration shows, the lamp can be made to enter largely into the decorative scheme of the car.

The extension of the Pintsch Company's supply stations during the last year makes the gas available in all parts of the United States, Canada and Mexico, and at places where only a small supply is required, the policy of this company is to furnish transport holders to be placed on flat cars, running to the gas plants for charging.

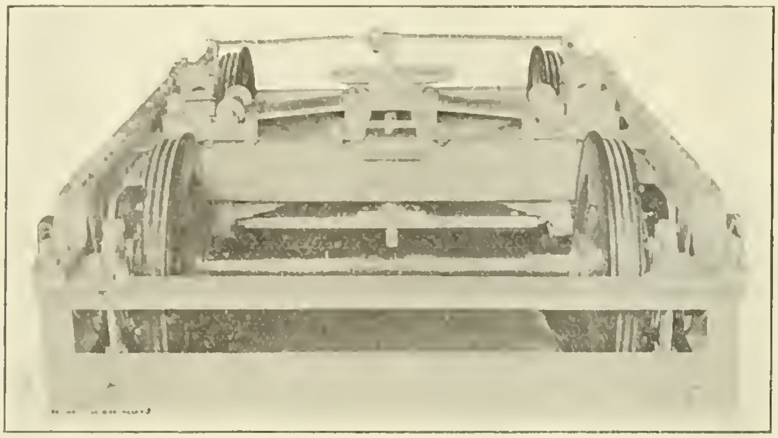
How They Tried to Punish the Railway.

Railroad companies frequently have occasion to reflect in their dealings with the law and more especially with politicians that it makes the greatest difference as to whose ox is gored. A case in point comes from Augusta, Ga. As everybody familiar with American geography knows, Augusta is situated upon the Savannah river, a fine stream with navigation possibilities that are not fully realized. About a year ago some enterprising citizens of Augusta came to the conclusion that the navigation of the Savannah was obstructed by the Southern Railway bridge near the city having no draw. These enterprising citizens, headed by the mayor, set their political powers in action to enlist the influence of Senator Bacon and other Georgia statesmen to use their influence with the Government to compel the Southern Railway Company to put a draw in their bridge. All went smoothly for the citizens of Augusta, and the Government engineer having made a report that the railway bridge obstructed navigation, an order was issued requiring the owners to make the change demanded.

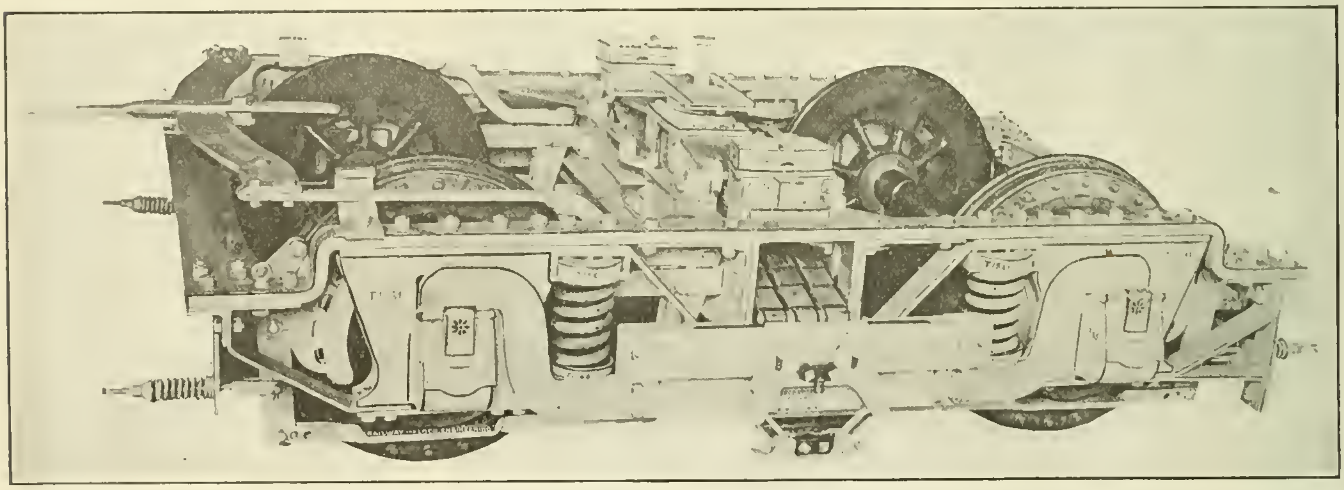
General satisfaction reigned for a few weeks in the city of Augusta, for their enterprising public men had "put the railway company in a hole," as they expressed it, in revenge for a refusal to put in expensive sidings that friends of the Augusta statesmen wanted. But it is always dangerous to let loose the Government investigation demons. The engineer continued examining the navigation possibilities of the Savannah river and he found that it was obstructed by two bridges belonging to the city of Augusta that had not been provided with draws, and a supplementary report moved the War Department to order the city bridges to have draws put in at once.

When an estimate of the cost of changing the two bridges was made it was found that the people of Augusta would be taxed $60,000 to have the improvement made which they did not want. The high spirited mayor and the illustrious Senator Bacon with his political henchmen are striving as hard to have the order to change the bridges withdrawn as they were to have it issued.

Nemesis may, however, come upon the taxpayers in spite of the efforts to repudiate their demands for a draw on the railway bridge. People higher up the river have learned about their rights in the maintenance of unobstructed navigation and their influence may prevent the Secretary of War from recalling the order.



TOMASSEK SAMPERS NOISELESS WHEEL TRUCK.



TOMASSEK-SAMPERS NOISELESS WHEEL TRUCK.

Noiseless Car Wheels.

A pair of noiseless car wheel trucks are on exhibition in New York. The wheels are made after the Tomassek Sampers patents and they will practically end the awful noise that our cities suffer from through the hammering of steel tires on steel rails. The annexed engravings show wheels and truck .

The trucks used are of the M. C. B. type, known to the trade as Peckham's extra strong high speed M. C. B. No. 46 and vary slightly from the Peckham standard dimensions.

The wheel centers are of cast steel, with independent combination tires.

The tires consist of vulcanized rubber, moulded into steel disks which are united by means of thimbles to form a truss, intended to carry the bulk of weight, while the rubber serves the two-fold purpose of killing all sound and substantially increasing the traction of the wheel.

The rubber portion of the wheel tire, being of slightly greater diameter than the steel members referred to, is compressed on the rail head under weight of the car, thereby eliminating all vibration and shocks in the rail, as well as in the wheel, and making skidding and slipping of the wheels an impossibility. The wheel is supplied with independent braking surface, cast on spokes of the wheel center, to which brake-shoes are applied. By thus shifting the braking from the face of the wheel proper, another important point is gained for the life of tires. The wheel completed, is of scientific construction and bids fair to increase the mileage made by all-steel tires in service on electric and steam railways, saving wear to rails and to special track construction and increasing life of motors and car equipment.

Modifications of these tires are being constructed for heavy motor trucks, and they promise to make a wheel that combines durability and absence of noise.

These trucks vary slightly from the Peckham standard dimensions, owing to the method of brake apparatus and brake shoe application to the wheels at a point other than customary, to wit: The wheel treads consisting practically of rubber, the braking surface, attached on the outer surface of the wheels, necessitates an increase of truck frame in width of 2 inches. The distance to center to center is 6 ft. 8 ins. (the Peckham standard being 6 ft. 6 ins.).

The truck bolsters are M. C. B. type, 10 ins. wide, resting on two sets of triple elliptic springs 32 ins. long, 3 x 7-16 in. stock, and five plates and are supported by solid links 3 x ⅞ in. stock with 1¾ cold rolled steel bar passing through the links and over the bolster and resting in brackets bolted to the transoms.

The transoms are channel irons 10 x ¾ x 3 in. legs. The equalizing bars are double 5 x 1 in. supporting equalizing truck springs 7 ins. O. D. by 12 ins. free height by 1⅛ in. round stock and inside buffers. Journal box pattern No. T 856 for 4¼ x 8 in. M. C. B. journal, brass and wedge. The yoke or pedestal pattern T No. 1231 malleable iron machined and carefully fitted to truck frames and journal box. Truck top frames 4 x 1½ in. soft steel, secured at the ends by angle irons 4 x 6 ins., and the corners reinforced with gusset plates as well as at the transom channels at the middle of top frames to insure the trucks square and alignment. Axles are 5 ins. for motor bearings, 5½ ins. at gear seats and are key seated; each axle is fitted for G. E. 66 B motor and the trucks provided with suspensions for the motors.

Each truck is fitted with truck and car body swivel or center plates, and double roller curve side bearings. Both sides of each truck are provided with brackets on the equalizer bars for the third rail collector shoe beams, and collector beams and shoes are attached to one truck complete.

Compound Freighter for the Central Vermont.

A short time ago the Central Vermont Railroad bought some heavy freight power from the American Locomotive Company in the shape of several compound 2-8-0 engines of the Richmond type. These machines were built in the Schenectady shops of that company.

The cylinders are 22½ and 35x32 ins. and the driving wheels are 57 ins. diameter. The calculated tractive force exerted with 210 lbs. boiler pressure is 38,200 lbs. The weight of the whole engine is 192,500 lbs., and the amount carried on the drivers is 167,500 lbs. The leading and the trailing driving wheels are flanged, while the main driver and No. 2 have flat tires.

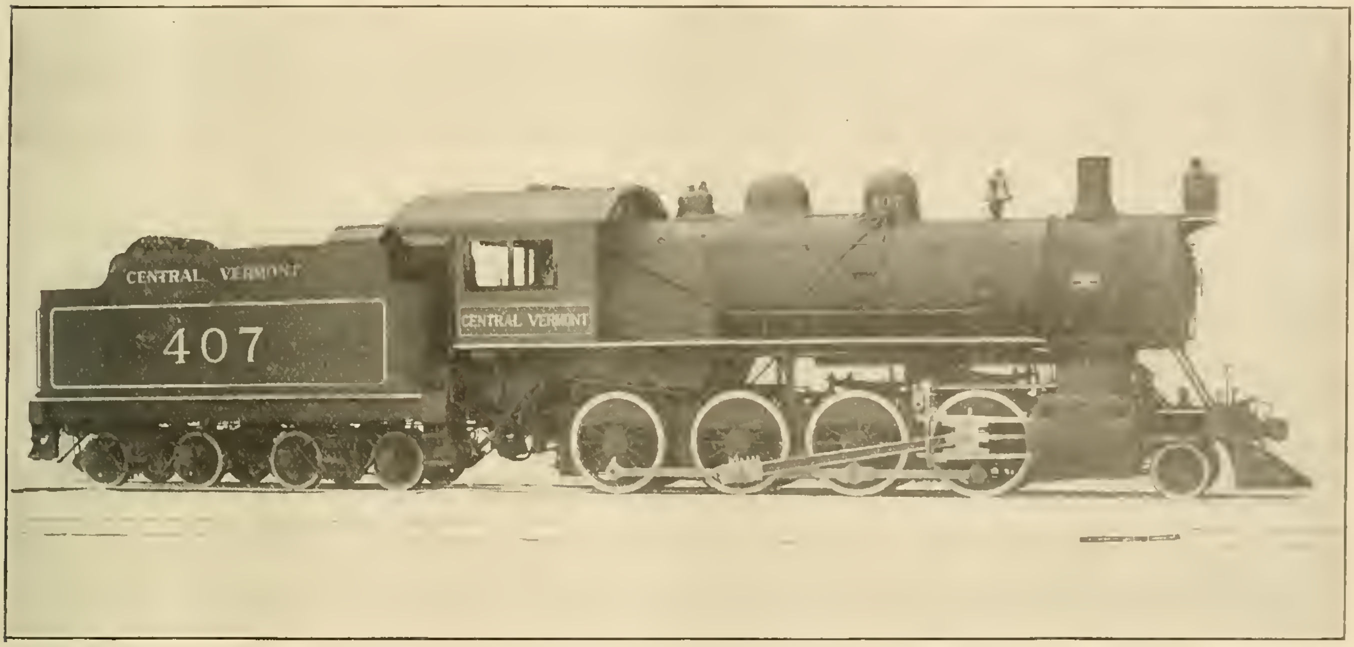
The main valves on each side are of different kinds. The low pressure cylinder is on the right side and steam distribution to it is governed by an Allen-Richardson slide valve, while the high pressure cylinder, on the left side, has a piston valve. The valve motion is indirect, but a transmission bar passes over the axle of the second driver from a link with 48 in. radius. The main rods are of I-section and each is 10 ft. 9 ins. long.

The boiler is of the extension wagon top type. The outside diameter of the barrel at the smoke box end is 68⅜ ins., while the outside diameter of the dome course is 76 ins. The flues are 353 in number, 2 ins. diameter and 15 ft. long. These flues give a heating surface of 2,757 sq. ft., which, added to that of the firebox, viz.: 154.9 sq. ft., brings the total up to 2,911.9 sq. ft.

The fire box is of the wide type, being 69⅛ ins. long and 75¼ ins. wide, which gives a grate area of 50.62 sq. ft. Crown and roof sheets are both level and there is a clear water and steam space between them of about 23 ins., while the mud ring, as can be seen in our illustration, slopes at a considerable angle to the front. The dome is 30 ins. in diameter and 19 ins. high.

The tender is of the usual U-shaped style and the capacity of the tank is 6,000 gallons of water and 14 tons of coal. It has a very high coping on both sides of the fuel space. The tender frame is made of 13 in. steel channels and the whole is carried on arch bar trucks. The weight of the engine and tender is about 327,800 lbs. The engine wheel base is 25 ft. 6 ins., while that of the engine and tender is 53 ft. 10⅞ ins. A few of the principal dimensions are apended for reference:

Wheel Base—Driving, 17 ft.
Axles—Driving journals, main, 9 x 12 ins.; others, 9 x 12 ins.; engine truck journals, diameter, 6½ ins.; length, 12 ins.; tender truck journals, diameter, 5½ ins.; length, 10 ins.
Fire Box—Thickness of crown, ⅜ in.; tube, ½ in.; sides, ⅜ in.; back, ⅜ in.; water space, front, 5½ ins; sides, 4½ ins.; back, 4½ ins.
Crown Staying—Radial.
Boxes—Driving, main, cast steel; others, cast steel.
Pump—11-in. left hand; reservoir one., 24½ x 140 ins.
Engine Truck—Two wheel swing center bearing.
Piston Rod—Diameter, 3¾ ins.; packing, C. I. rings.
Valves—Type H. P. piston; travel, 6 ins.; steam lap, 1¼ ins.; L. P. Allen Richardson steam lap, 1 1/16 ins.; exhaust clearance, 5/16 in.
Setting—1/16 in. lead in full gear; F. & B. both high and low pressure cylinders.



HEAVY CONSOLIDATION ON THE CENTRAL VERMONT.
A. Buchanan, Jr., Superintendent of Motive Power. American Locomotive Company, Builders.

A Bold Bridegroom.

It was on a corridor train going South. Among the passengers was a newly-married couple, who made themselves known to such an extent that the occupants of the carriage commenced whispering and sniggering. The bride and groom stood the remarks for some time, but finally the latter, who was a man of tremendous size, broke out in the following language at his tormentors: "Yes, we're married —just married. We are going one hundred and sixty miles further, and I am going to 'spoon' all the way. If you don't like it you can get out and walk. She's my violet and I'm her sheltering oak." During the remainder of the journey they were left in peace.—*S. A. Ry. Standard.*

A Chinese engine driver, running a big American locomotive and running it well, is to be seen on the Canton-Hankow Railroad. His name is Loy Yee, and he used to be second pantryman on the steamship Coptic. The purser of the Coptic saw him the other day. "Velly fine lengine," he said, "plenty fast."

Here is a genuine fake which was sent to New York Press dispatches with the heading "To Feel Clerks' Bumps":

"In the headquarters of the Union Pacific Railroad to-day a contract was entered into with J. M. Fitzgerald, a Chicago phrenologist, to examine the bumps of the sixty clerks in the passenger department. The object of the examination is to determine which department of railroading the subject is best fitted for."

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Master Mechanics' Convention Work.

Now that the excitement attending the meetings of the International Railway Congress is over, railroad mechanical officials are directing their attention to the coming mechanical convention that will be held at Manhattan Beach this month. It is to be hoped that the time devoted to attendance at the Washington meeting will not be the means of curtailing the attendance at the Master Car Builders' and the Master Mechanics' conventions, which are of much greater importance to the interests of American railroads than the more imposing congress just passed.

Both the Associations are well loaded up with subjects to be reported upon by investigating committees, a curious feature about both being that the subjects waiting for investigation seeming to increase as the years go by in spite of the work done by railroad clubs and other organizations.

The Master Mechanics' convention is scheduled to begin routine business by hearing a report from the chairman, C. H. Hogan, on that well-threshed subject, the Proper Loading of Locomotives. The question calling for further light is: What should be the practice underlying the proper loading of locomotives on the basis of conducting transportation with the greatest efficiency and at the least cost, considering all the factors individually? It is, in short, our oft-discussed question, What is the most economical load for a locomotive? If new light can be thrown on this subject our transportation friends will thank the committee. We incline to think that there are few phases about the loading of locomotives that Mr. Hogan is not familiar with. The subject is in good hands.

Locomotive Tests of Pennsylvania Railroad Company, at St. Louis Exposition, comes next. If Mr. F. H. Clark, chairman of this committee, can submit a comprehensive report, the information imparted will be highly valuable not alone to our railroad companies but to all the railways in the world.

Locomotive Front Ends is one of the subjects carried over, and is becoming a little tiresome, but Mr. H. H. Vaughan, who is chairman of the committee, may have something to say about the tests carried out by Professor Goss that will inspire new interest into the question.

Locomotive Driving and Truck Axles and Locomotive Forgings will be reported upon by a committee of which Mr. F. H. Clark is chairman. His part of the work is to submit specifications after they have been considered by the International Railway Congress.

Shrinkage Allowance for Tires, is the next subject, with Mr. F. J. Cole chairman of the committee. The purpose is to consider whether the present shrinkage allowance, 1/80 in. per foot is sufficient for the large diameter wheels with cast steel centers. The existing standard allowance was quite satisfactory for cast iron centers, but changed material and conditions require a change of allowance, and we have no doubt that this committee will recommend a change that will be satisfactory to all concerned.

Motive Power Terminals is a far-reaching subject to be reported on by a committee of which Mr. Donald R. McBain is chairman. He is required to solve the problem of how locomotives can be got ready to leave terminals most promptly with all the necessary repair work done at the least possible cost? Also to tell the best method of heating and ventilating roundhouses. He is asked, in short, to reduce locomotive terminals to the basis of a machine for treating and handling engines. We suspect that this is a case where the machine-like precision is of less importance than the personal equation. A good, energetic, far seeing foreman, who will have everything ready for emergencies and will hustle the work through is worth any amount of machine methods. Still a well appointed roundhouse is one of the best investments a railroad company can make.

Flexible Stay Bolts will be reported upon by Mr. R. N. Durbonow, who will tell something about the number of flexible stay bolts in use and submit information about the value of this device as demonstrated in service. From a reasoner's standpoint a flexible stay bolt ought to be one of the most valuable improvements ever introduced for keeping the outside and inside sheets of a fire box bound strongly together; but practical use does not always sustain theoretical reasoning, and all concerned in the safety of locomotive boilers will be glad to know how flexible stay bolts have gone through the ordeal of service, for few people yet know anything about them.

That perennial subject, Water Softening for Locomotive Use, comes up again under the ciceronage of Mr. J. A. Carney. Whatever may be said on the subject may be depended upon as reliable, for the chairman of the committee has enjoyed many years' acquaintance with feed water in all its manifestations. We have paid close attention ourselves to this subject for a long time and it seems to us that the results obtained of late years from water purifying appliances have been more encouraging than they ever were before. A water purifying plant will not operate properly without intelligent supervision. Carelessness has been fatal in the past to many promising water purifying devices. The people supplying the more modern purifiers insist that they are properly attended to, which goes a long way towards assuring their efficiency.

Service of Locomotives, the ninth subject, will be handled by Mr. William Forsyth, who is directed to report upon the average engine hours per annum locomotives are in service, in shop under repairs, or waiting to get into the shop, and the percentage of total time locomotives are actually in and out of service per annum. The purpose of asking for this report is not very clear, for everybody knows that the time locomotives are kept in the shops undergoing repairs depend upon the facilities provided for performing the work. The question came up at the thirty-second convention in a report on The Advantage of the Ton Mile Basis of Statistics, but no member considered it of sufficient importance to make remarks about it.

Shop Layouts is the curious title of a subject assigned to Mr. R. H. Soule, with a good committee, his work being to report upon the question of shop layouts for roads having 350, 500, 750 and 1,000 locomotives. If this committee can recommend plans for shops that will be sufficiently satisfactory to prevent the man in charge from wishing, as soon as they are finished, that they had been built according to some other plan, they will be public benefactors.

That closes the list of subjects for the Master Mechanics' Convention, and it does not err on the side of brevity, for there will be topical discussions that are always interesting and valuable besides the incidental business that always comes up to consume time.

Business of Master Car Builders' Convention.

The most important work done annually by the Master Car Builders' Association is the discussion of the Rules of Interchange of Cars. It is highly important, but the discussions are remarkably tedious and give aluring opportunities to the man who enjoys listening to the sound of his own voice; but the ordeal, which becomes more protracted year after year, must be gone through.

There are ten subjects to be reported on at the ordinary meetings, representing considerable work, but there is nothing of exciting importance like what used to cause heated conflicts in the days when the adoption of certain standards were under consideration.

A committee, of which J. E. Muhlfeld is chairman, will submit a design for arch bar for 100,000 pounds' capacity cars.

Subject No. 2 is called Safety Appliances, with D. F. Crawford chairman. This committee will confer with the Interstate Commerce Commission in regard to standards of the association, and prepare designs for ladder, location of ladder and location of hand holds on roof.

Last year a most comprehensive report on Tank Cars was made by a committee, of which A. W. Gibbs was chairman. The report went very fully into the designing of tank cars, and particulars were given of experiments conducted by the Pennsylvania Railroad Company with safety valves designed to relieve the excess pressure that sometimes accumulated when volatile oils were carried. There was considerable discussion about the methods of fastening tank cars, and a car of this character without an underframe, which was illustrated, excited some conflict of opinion. A motion was carried to present the report to the American Railway Association, and the result of that action will form No. 3 report at the coming convention.

What seems to us the most important subject to be brought before the convention is that on Repairs of Steel Cars, T. H. Russum being chairman of the committee. Mr. Russum is superintendent of the car department of the Baltimore & Ohio Railroad, and the probability is that he has sufficient personal experience in repairing steel cars to draw from to supply material for an edifying report. Steel cars have come very rapidly into popularity, and it is natural that the facilities for carrying out repairs have lagged behind the needs of the case. If Mr. Russum gives particulars of methods or appliances which will reduce the cost of repairing steel cars he will be a benefactor of most roads handling such cars.

In this connection mention might be made that we recently heard a superintendent of machinery say that the stiffest, most rigidly built steel cars were more expensive to repair than the lighter cars that were yielding when heavily shocked. The weak car took the blows and returned to its original shape, while the rigid car took a permanent set.

The other subjects to be reported on, while important in details of car management, are not likely to excite interest out of car building circles. They are: Steam Connections, H. F.. Ball, chairman; Passenger Car Rules, J. T. Chamberlain, chairman; Air Brake Hose, Le Grand Parish, chairman; Coupling Chains, R. P. C. Sanderson, chairman; Stenching Cars, H. M. Carson, chairman; Doors, J. E. Keegan, chairman. J. S. Chambers is chairman on the selection of subjects for next year's convention.

Long and Short Fire Boxes.

The illustration which we published in our May issue of Manchester's Chicago, Milwaukee & St. Paul 4-6-2 engine with long deep fire box has brought us considerable correspondence and inquiry. The short wide fire box, which jumped into popularity with the advent of the Atlantic type of engine, has been in service long enough to develop its shortcomings, which in some respects have been rather serious, and many of our friends have asked if the engine built by Mr. Manchester is not a move backwards towards a more satisfactory form of fire box? Not being possessed of sufficient information concerning the relative merits of the long deep and of the wide shallow fire box, we have made diligent inquiries among the railroad men who have had large experience with both forms, and the evidence has been decidedly in favor of the latter.

Most of the motive power men we talked with took the stand that a fire box over ten feet long cannot be fired properly, and it is impracticable to provide sufficient grate area to generate the steam necessary to haul fast heavy trains. The men who have enjoyed extended experience of both kinds of engines are in the best position to judge of their relative merits, and we accept their decision.

James Watt, by Andrew Carnegie. Doubleday, Page & Co., New York.

James Watt, the great inventor, was born in Greenock, Scotland, in 1736 and died in 1819, his labors on the development of the steam engine having been completed several years before he passed away. The world has been indebted more to James Watt for stimulating the commercial progress of the last century than to any other inventor, or set of inventors, for he provided the industrial foundation. Moved by these considerations a multitude of writers have labored for more than a century to sing the glories of Watt's achievements; yet it has remained for a man of the twentieth century to give to literature the most faithful and lifelike portraiture of the inventor of the steam engine. The book on James Watt by Andrew Carnegie is evidently a work of love, and tells the story of the inventor's life with the kindly touches that show us the patient industry, the astounding inventive fertility and the powerful constructive genious of a hero with beautiful settings of domestic and fraternal virtues. Considering the kind of story told, it is burdened very little by technical details and is truly the romance with great achievements forming the work of a noble life.

The book tells the story of the childhood and youth of Watt, the story of his manhood and busy strenuous life, the story of his invaluable inventions, of his old age and a critical estimate of the great man. The narrative is not the steady flowing river that keeps straight on steadily towards its goal. At nearly every page excursions are made into side scenes in which we are introduced to many of the author's friends and receive impressions of his strong personality.

In the preface Mr. Carnegie tells about being asked to write the life of Watt, and declining on the first impulse, then reflecting that he knew little of Watt or of the steam engine, and the surest way to obtain the knowledge was to write the book. We commend this incident to the attention of our ambitious young readers. When you want to know all about any subject, undertake to write something about it. We know of no better stimulant to the acquirement and cultivation of exact knowledge.

In telling about the shop experience of Watt, Mr. Carnegie remembers many things that appeal to the mechanic proud of his handicraft. Speaking of the first tool made by Watt the author says:

"It is probable that this first tool finished by his own hands brought to Watt more unalloyed pleasure than any of his great triumphs of later years." * * *

"Writers upon labor, who have never labored, generally make the profound mistake of considering labor as one solid mass, when the truth is that it contains orders and degrees as distinct as those in aristocracy. The workman skilled beyond his fellows, who is called upon by his superintendent to undertake the difficult job in emergencies, ranks high, and probably enjoys an honorable title, a pet name conferred by his shopmates. Men measure each other as correctly in the workshop as in the professions, and each has his deserved rank. When the right man is promoted, they rally round and enable him to perform wonders. Where favoritism or poor judgment is shown, the reverse occurs, and there is apathy and dissatisfaction, leading to poor results and serious trouble. The manual worker is as proud of his work, and rightly so, as men are in other vocations." * * *

"Thus is human nature ever the same down to the roots. Many distinctions, few differences in life. We are all kin, members of the one family, playing with different toys.

"So deep down into the ranks of labor goes the salt of pride of profession, preventing rot and keeping all fresh in the main, because on the humblest of the workers there shines the bright ray of hope of recognition and advancement, progress and success. As long as this vista is seen stretching before all is well with labor. There will be friction, of course, between capital and labor, but it will be healthy friction, needed by, and good for, both."

There are combinations of race blood that are famous for producing strong progeny just as the combination of certain elements produce striking compounds. In James Watt the blood of the elusive Celt and the sturdy Northman were combined and produced the inventor who always possesses the attributes of the poet and of the deep reasoner. Watt had a higher inheritance than wealth, his heredity led him towards the use of tools that were handled with the skill of the natural mechanic. Taste and circumstances led him to learn the trade of mathematical instrument maker, but the handicraft was acquired in an irregular manner which brought him in conflict with the Trade Guilds of Glasgow and they prevented him from working or opening a shop within the city of their jurisdiction, because he was not the son of a burgess and had not spent seven years on a regular apprenticeship. The trades union of to-day had a very exacting predecessor in the eighteenth century guild.

Yet Watt was not only an excellent mechanic but a man unusually well informed concerning the principles underlying the mechanic arts. He had the repute of one who knew most things and could make anything. "Good work," as the author says, "always tells. Ability can not be kept down forever; if crushed to earth it rises again." Genius is said to be the capacity for taking infinite pains, a characteristic remarkably strong with Watt. Not only did he strive with all his might to do, as it best could be done, the work that came to his hand, but he was at great pains to acquire all the knowledge available concerning the work and its line of industry.

Fortunately for Watt there was in Glasgow a university that was outside the control of trade guilds, a university, too, famous for its devotion to science and to the investigation of all departments of knowledge relating to nature and its laws.

The professors of this university, many of whom became famous, decided to give Watt a room in the establishment where he could work free from trade restrictions. Watt, thankful for the privilege given, proceeded to make his living at the trade of mathematical instrument making, which seemed to embrace all the instruments of precision known to that time.

The University of Glasgow has been famous for the labors performed in the interests of practical science. It was the first university to establish an engineering school and professorship of engineering; first to establish a chemical teaching laboratory for students; first to have a physical laboratory for the exercise and instruction of students in experimental work. It was not surprising, then, that James Watt found the university owned a working model of a Newcomen engine. Experiments with this model carried Watt into the field of steam engineering and led to the invention of the modern steam engine.

The Newcomen engine was operated mostly by atmospheric pressure and consisted of little more than a cylinder and piston, the latter connecting with a walking beam which worked a pump rod. To begin operations the uncovered piston was at the top of the cylinder moved there by a counter weight on the walking beam. Steam was admitted beneath the piston and when the cylinder was full a jet of water was injected into the cylinder which created a vacuum and the atmospheric pressure pushed down the piston, effecting a stroke. The counter weight then raised the piston to the top of the cylinder again and the process was repeated.

When Watt proceeded to experiment with the model of this engine he soon discovered that it took an enormous volume of steam to do the work, and following the law of his nature, he set about finding out what caused the waste of steam. It was found to be the "cylinder condensation," an expression that afterwards became very familiar to steam engineers and is still much in evidence. Injecting water into the cylinder at each stroke made it a condenser for a great part of the steam admitted on the succeeding stroke, thereby wasting a great proportion of the heat required to do the work. By an inspiration of genius, Watt conceived the idea of condensing the steam in a separate vessel and the secret of his successful engine was discovered.

Want of space forbids us even to allude to the difficulties, failures, obstacles and disappointments that paved the way to Watt's successes, but by unremitting toil, guided by intelligent persistence, he produced the steam engine which does the hard work and carries the burdens of the world.

Mr. Carnegie does not weary the reader with dry details, but deals with results, carrying the reader along with the zest for the succeeding acts such as the boy enjoys in following the fortunes of Robinson Crusoe and other popular heroes. All the reading world knows of James Watt as the inventor of the steam engine, but it has remained for Mr. Carnegie to give to literature a new romance creating a transcendent hero of industry.

In the preface the author says: "I am indebted to friends Messrs. Angus Sinclair and Edward R. Cooper for editing my notes upon scientific and mechanical points."

The book is for sale in the Book Department of this office.

Award of Medals of Honor.

President Roosevelt has issued a circular containing regulations, governing the award of life-saving medals under the act of Congress of February last. The intention of Congress was, no doubt, good in providing the funds to pay for medals of honor to railroad men who have performed acts of extreme daring in endeavoring to save life; but we are very much mistaken if great injustice will not be inflicted in the selecting of the persons considered entitled to the medals.

When any person considers one entitled to a medal applications must be filed with the Interstate Commerce Commission giving particulars of the act of bravery and it must be supported by witnesses. A committee will then investigate the claim and make recommendation to the commission which will decide on the merits of each case.

Acts of heroism that result in life saving are of daily occurrence among railroad men, but it will be extremely difficult to decide on the act that constitutes extraordinary heroism. The most deserving type of heroism is performed by the man who attends faithfully to duty on occasions that involve severe hardships; but that life-saving heroism is not of the quality that will appeal to judges, they will want some ostentatious act that appeals to the dramatic tendencies of people and may look fine on the surface while really of little value.

In a half lifetime spent in train service, one act stands forth from the memory as the most heroic in our experience, but it was not of a character that would have earned a medal of honor. A freight train was standing across a railroad track that crossed almost at right angles on a steep grade and the engine of the train was putting off some cars. Suddenly the whistle of a train on the crossing road was heard and in a minute or two a tumult of whistling arose, intimating to the initiated that the approaching train was not under control and could not be stopped before the obstructing cars were reached. A brakeman who had just coupled the engine to the cars of the freight train took in the situation. He rushed back to the crossing waving for a slack coupling, sprang between the cars, pulled the coupling pin, signaled the engine ahead and made an opening in the train just as the engine of the transecting train rushed through it. The passenger train had seven cars crowded with excursionists, and there was a gulley 50 ft. deep at the side of the crossing. The act was regarded so lightly that no one made a single remark about it. It was not of the spectacular kind and the chief actor would never have been awarded a medal, but his prompt action saved many lives.

Book Review.

Electric Railways, by Sydney W. Ashe, B.S., and J. D. Keiley, Asst. Elec'l Engr., N. Y. C. & H. R. R. R. Publishers, D. Van Nostrand Company, New York. 1905. Price, $2.50.

The aim of this book, which contains over 280 pages, is to treat the subject of electric railways in a practical as well as a theoretical manner, the dual authorship of the book would suggest that mode of treatment, and it has been well carried out. This work is designed to be a modern text-book on electric railways, as it embodies recent developments in electric traction. It is intended for use in technical institutions and also to be employed as a general engineering reference book for those interested in and those working on problems which come up for solution in this kind of railroad work.

The effort of the authors has been to eliminate higher mathematics as much as possible, and where it is necessary to use the calculus the same problems are set down in algebraic form. The book is well illustrated throughout both with line engraving and half-tones, and the printing has been executed in clear and easily read type. The pages are 7½x5¼ inches.

The subject is divided into eleven chapters, the first deals with units, curve plotting and instruments. Next comes one on the analysis of train performance, then train recording and indicating instruments, direct current series railway motor, alternating current single phaze motors and types of control and their operation. Chapter VI deals with car bodies, and the next with trucks. In this chapter there are two plates, one showing a perspective view of a maximum traction truck, and the other that of an ordinary four wheel truck. In both of these the names of each part is given with arrow from the name to the representation of the part. Chapter IX relates to brakes and braking; X, to electric locomotives and the last chapter takes up electric measurements. The book should be useful to all who are interested in electric traction.

Action of an Electric Transformer.

Have you ever noticed a mysterious-looking iron box hanging from the crossbar of a telegraph pole near the shop? The box is usually high up and well out of the way and has four wires connected to it, which enter near the top. The box contains what is called an electric transformer.

The action of the transformer is really simple, though it may not appear so at first sight. To begin with, the power house generates an alternating electric current at high pressure, or, as it is called by electricians, at high voltage, and this current is produced in small quantity and is in a certain sense like the compressed air in the train pipe of the Westinghouse brake. This small quantity high pressure current requires a comparatively small copper wire to carry it, and the installation for such a current is economical of copper, and its maintenance charge reasonable. The economy of alternating current transmission does not depend on the voltage, but on the ampere capacity of the wire. That is why this kind of current is generated. It is best suited for transmission from the power house to the shop.

When it gets to the shop it happens that it is not the kind of current which the shop wants for consumption in its numerous glow lamps and its small motors for running machines, and it is necessary to change this current into the kind that the shop can use economically. The shop wants low pressure, or low voltage, if you please, and greater quantity of current. Alternating current it must be, of course. The current for shop use has to be more like the air supplied to a blacksmith shop, which is of only a few ounces pressure, but there is plenty of air.

We have, therefore, two kinds of current, each good in its place, and the action of the transformer is to change power house current into shop-use current. The power house current travels over a small wire and when it enters the transformer it is still provided with a small wire to travel on which is carefully insulated and wound round a soft iron core, in a great many separate turns, and a small wire leads it out of the transformer and back to the power house after it has traversed the many fine wire coils. This soft iron core extends beyond this fine coil, and on this extension are wound a few turns of heavy copper wire and each end of the large copper wire goes to the shop. The fine wire from the power house runs in and out of the transformer, and so does the heavy shop wire, and neither of them is in actual contact; both are insulated and wrapped round the soft iron core. These fine and coarse coils and the soft iron core form altogether the electric transformer.

The action of the transformer, when the alternating power house current flows is briefly this: The high voltage current in the fine wire magnatizes the soft iron core, and the magnetic lines created by this current set up an induced current in the neighboring heavy wire. This induced current flows to the shop. The relative number of windings in each determine just what the transformer will do. If it was desired to transform a 2,000 volt current into a 100 volt current, the fine wire coil would require 20 windings to 1 of the heavy wire coil, and with the small loss due to the action of any man-made machine, in this case between 2 or 3 per cent., we can take out of the transformer very nearly all the energy we put into it. This kind of a transformer is called a step-down transformer. It would be called a step-up transformer if the primary current flowed to it from the shop. In such a step-down transformer as the one we have been considering, if we desire to take out of the secondary, 100 amperes at 50 volts, we would have to put into the primary at least 5 amperes at 1,000 volts. Amperes are units of current quantity. The product of amperes and volts in each case is equal, where the slight losses in the transformer are neglected.

Making Trade Schools a Necessity.

At the National Association of Manufacturers' Convention, held at Atlanta, Ga., last month, a report of the Industrial Education Committee said:

"Formerly the apprenticeship system offered to the American boy the opportunity to learn a trade, but to-day the changing industrial conditions, and the bitter and cruel opposition of organized labor as a whole, have nearly destroyed this former safeguard of opportunity.

"We weigh the meaning of our words when we say that this outrageous antagonism of organized labor to the apprenticeship system constitutes a crime against the youth of the whole nation. The American Federation of Labor in this respect has been and is now the meanest and most cruel of all trusts. The right of every individual, whether native or foreign born, to learn and earn what he can should be as free as the air we breathe.

"It is his natural and inalienable right, and only in free America is such a right denied. Even the youth of the empire of the Czar are free to learn a trade. It is only in our own country that this conscienceless labor trust has outraged the principles of the Declaration of Independence. Let there be no mistake about this. With the exception of the railway brotherhoods organized labor as a whole is uncompromising in its opposition to the trade school, the apprenticeship system and the open shop; they all involve restrictions on their attempted monopoly.

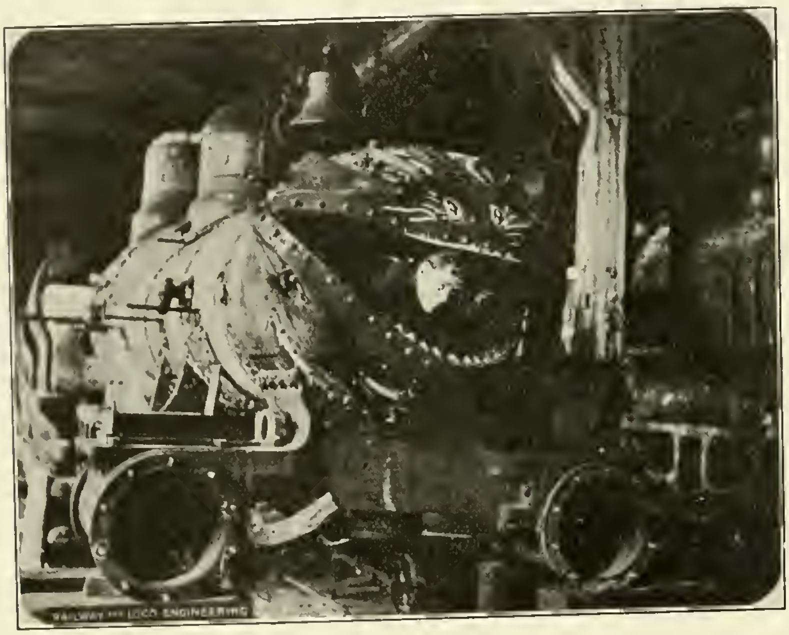
"But without this unaccountable antagonism there is the utmost necessity for the establishment of a system of trade schools that will take the place, in part at least, of our almost lost apprenticeship system with their newer and perhaps larger and brighter opportunities. And they will be established more and more generally in spite of everything."

Curious Wreck Imprint.

Enclosed you will find a photograph of a wrecked locomotive.

Two trains figured in a collision near Suisun, Cal., in which one engineer was killed and both locomotives slightly damaged. The front end of one of the damaged locomotives was stove in, and with the aid of a few chalk lines, the appearance compares strikingly with some of the fabled monsters of the deep, as the accompanying photograph shows.

W. Hesse.



CURIOUS WRECK IMPRINT.

Pulling at a Pullman Chair.

Have you ever noticed the curious desire which a man or woman displays when he or she enters a Pullman chair car? In ninety-nine times out of a hundred the chair is firmly fastened to the floor of the car, and is mounted on a large central casting, which permits the chair to revolve, but will not let it approach nearer or recede from the side of the car by so much as the sixteenth of an inch.

Well, you notice the passenger who is going to take possession of the seat. Without reflecting that the chair is practically immovable, he or she will endeavor to draw it forward just a little and will only succeed in turning it.

There is the busy business man who takes hold of the chair and if it has its back away from the window his effort will turn it half round, as if the new position was what he wanted all the time. Another less resolute or determined man will get it half way round, but he does it with a sort of a "If-I-get-it-wrong,-I-will-pay-for-it, air. There is the short-haired woman's tug, which means why are these chairs not all arranged so that the brutes of men will have to stand, and there is the turn of the chair through, perhaps, two degrees by the maiden fair who asks by that mute action if she may occupy it. Then there is the man who has a railroad pass for the first time, and he tries to pull the chair from one end of the car to the other, but only succeeds in making it spin, and so gives it a sort of a Too-much-bother-to-be-always-and-everlastingly-showing-your-pass style of chair movement, and lastly and for all time, the old women of both sexes who drag at and turn one chair to sit in, and half a dozen more to put bags on. There are all sorts of reasons why they try to pull these immovable revolving chairs, but they all take a try at it.

Tiny Locomotive for Japan.

The smallest locomotive ever built for freight service at the Baldwin locomotive works in Philadelphia, and probably in the United States, was recently sent to Japan. The tiny engine weighs only 2,500 pounds and is designed to do the work of two men in pulling narrow-gauge cars on a miniature railroad used to take tea, rice and other natural products out of the fields. The pulling of these cars has heretofore been done by coolies, and the little locomotive will be used as an experiment. If it is found satisfactory others probably will follow it to Japan.

In 1852, when the Galena & Chicago Union Railroad Management, the first portion of the Chicago & Northwestern Railway System, proposed substituting T-rails for the strap rails previously used, there was not a man west of the Lakes who knew how to lay the new form of rail. The company had to send to the Syracuse & Utica Railroad, in New York state, for a man to lay the track.

Some idiot hankering after notoriety made a statement in the public press that 95 per cent. of the business men in the country failed to meet their obligations, and it aroused quite a discussion. The managing editor of *Bradstreet's*, who may be regarded as an authority on the financial standing of business men, says that the failures are less than five per cent.

Many things work admirably when a mechanism is new, but the strains of service are frequently fatal to novelties.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. When a student wishes to receive a private answer, he is reminded that it is usual to send a stamped envelope for the return letter. We will be glad to answer any question relating to railway matters, but prefer that they be suitable for our question and answer department. All letters intended for Our Correspondence School ought to be addressed to Department E.

Before the School Course Can Be Used.

In connection with these Correspondence School Lessons, we think it well to explain the system of employment for trainmen which, in the course of time, enables the railroad man to present himself for examination.

The old practice of taking on a man as fireman or brakeman because he was a persistent applicant or a friend of some one who recommended him to a master mechanic, traveling engineer, superintendent or train master, has been abolished and a system put in its place intended to keep out men too ignorant to make intelligent railroad employees and to guard against physical weaknesses such as poor eyesight, epilepsy and other defects which might prove dangerous to themselves and others.

A system introduced by the Erie Railroad Company some time ago is fairly representative of what other railroad companies are doing. This is carried out by the Employment Bureau, in charge of William C. Hayes, formerly assistant superintendent of motive power of the Erie, and well known to enginemen through having been for years a grand officer of the Brotherhood of Locomotive Engineers. When a person wishes to enter the employment of the Erie for any position between official and laborer, he has first to fill out a blank recording the employment he has been in for four years. The acceptable age limit varies with the kind of employment applied for.

When the written application is found satisfactory for the candidate for employment, a medical examination has to be passed. When that is all right, then comes an examination by the Employment Bureau. The first test is reading train orders or other common handwriting. If a candidate appears smelling of liquor or has fingers stained with the mark made by profuse handling of cigarettes, preliminary disabilities may be noted against him. The test of reading being found satisfactory, the vision is next examined. The first is for color blindness, which is made by means of worsteds and lanterns. A collection of about fifty skeins of colored worsted is put upon a table and the candidate is directed to select all the reds, all the greens, all the whites, and so on. A color blind person readily picks out brown for red or green and makes various other blunders that mark his defect of vision. If the person passes the worsted test he is taken into a dark passage and given tests by lanterns of various colors and with model semaphore signals set in various positions.

Another test is for distance vision, which is carried out by printed lettering of various sizes, a system very familiar to the public by being used in oculists' establishments. Hearing is tested by the distance a candidate can distinguish the ticks of a watch.

When this examination is passed satisfactorily the candidate is placed on the list of persons available for employment. When the time comes for promotion he is invited to pass an examination similar to the course we have been publishing. Examinations for sight and hearing are made periodically by many railroad companies.

A candidate for railroad employment would do well to practice on selecting skeins of colored worsted, as we have noticed that men sometimes made mistakes through nervousness. A little familiarity with the practice would prevent one from becoming nervous.

Air Brake Questions and Answers—Continued.

27. What kinds of engineer's brake and equalizing discharge valves are used?

A. Three forms; the D-8 with the excess pressure valve, the D-5 with the poppet valve form of feed valve, and the E-6, F-6 or G-6 with the slide valve feed valve attachment. These three forms are all of the equalizing discharge type, and have respectively excess pressure valve, the poppet valve feed valve, and the slide valve feed valve. The initial and figure designations given the forms of valves are those used in the different catalogues of the manufacturer.

28. How is the amount of excess pressure regulated when the G-6 brake valve is used?

A. The slide valve feed valve attachment is adjusted by the regulating spring to control the train line pressure when the brake valve handle is in running position. The air pump governor is adjusted to control the amount of pressure to be carried in the main reservoir. The difference between these two pressures is what is commonly known as "excess pressure," and is used for releasing and re-charging the brakes.

29. How is the excess pressure regulated with the D-8 brake valve?

A. With the excess pressure valve spring. This valve will give the amount of excess pressure desired by placing behind the valve a spring of sufficient tension or resistance to cause the difference between the main reservoir pressure and the train pipe pressure. For instance, if 20 pounds excess pressure is desired, the spring is so prepared that when the brake valve handle is in running position the main reservoir pressure passing to the train pipe will meet a resistance of 20 pounds, thus giving 20 pounds more in the main reservoir than in the train line.

30. How should the feed valve of a G-6 brake valve be cleaned?

A. The stop cock in the train pipe under the brake valve should be closed, and all train line pressure drawn off the brake valve with the handle in service position, thus eliminating all chance of the parts being roughly moved or injured when the valve attachment is taken apart. Then remove the large cap nut, and take out the piston spring and slide valve. Clean these parts carefully, taking care that no lint or dirt remains on the parts. Oil the slide valve and its seat very sparingly with a good quality of oil, then replace the parts carefully. Next remove the diaphragm valve, clean it carefully, taking especial care not to bruise or scratch its ground surface. The same care should be exercised in cleaning the diaphragm valve seat, observing that none of the small ports are stopped or clogged with dirt or foreign matter. No oil is necessary on the diaphragm valve and its seat. As a rule it is unnecessary to remove the regulating spring and diaphragm, but when it is necessary, it should be done by the repair man, and not when the engine is in service on the road, if it can be avoided. In fact, all work possible should be done on the brake valve by the air brake machinist, either in the roundhouse or machine shop.

31. Name the different positions of the brake valve?

A. Full release, running, lap, service application, and emergency application.

32. In what position of the brake valve is there direct communication between main reservoir and train pipe?

A. The first, or full release, position.

33. Is there no other position of the brake valve in which the air may pass from the main reservoir to the train line?

A. Yes, running position; however, in

running position the air passes indirectly, or through the passages and ports of the feed valve attachment, in order to get from the main reservoir to the train line.

34. When making a service application, do you draw air direct from the train pipe?

A. No. In service application the engineer draws air directly from the small equalizing reservoir and from the chamber on top of the equalizing piston. This reduction causes a differential in pressures acting on the piston, and the train line pressure under the equalizing piston being greater, causes the piston to rise and discharge train line pressure at the angle fitting of the brake valve until such time as the latter pressure becomes lower than that remaining on top of the piston, when the piston will descend, closing off the discharge of train line pressure.

35. With the G-6 brake valve in running position, if the black hand of the

MANUNCACHUNK TUNNEL ON THE LACKAWANNA SHOWING DERAILING SWITCH NEAR ENTRANCE.

gauge goes up and equalizes with the red hand, what is the defect?

A. As the black hand indicates train line pressure, and the red hand main reservoir pressure, the train line pressure is evidently being increased, due to the leakage of main reservoir pressure coming into it. This leakage of main reservoir pressure into the train line pressure may be due either to a leaky rotary valve or leaky body gasket. Also, there may be a leakage in the feed valve attachment past the supply valve, or in the attachment gasket, or the regulating spring may be improperly adjusted.

36. How can it be ascertained which one of these defects is causing the trouble?

A. Discharge all air from the brake valve. Place the brake valve handle on lap and start the pump. If there is a leakage of main reservoir pressure into the train line, which will be indicated by the rising of the black hand, the trouble is either in the rotary valve and its seat, or in a defective body gasket. However, if the black hand does not rise while handle is on lap position, but if both hands go up together in running position, above the figure the feed valve adjusting spring is set for, the trouble is probably either in a faulty supply valve in the feed valve attachment, or in the small gasket between the feed valve attachment and the brake valve body.

37. What is the effect of leakage from the equalizing reservoir, or the connections to the small chamber above the equalizing piston?

A. When a service application is made, the leakage from the equalizing reservoir in the chamber above the piston will cause more air to escape than is desired by the engineer, the equalizing piston will remain raised off its seat longer than intended, and more pressure will be drawn from the train line than desired, thus making a heavier application than is wanted. In other words, a continuous, or at least prolonged, application will be made, and the engineer will be unable to reliably regulate the flow of pressure from the train pipe in service application. In release and in running positions, this leakage will merely mean a waste of air pressure. On lap, train line pressure will continue to escape at the angle fitting, either slowly or rapidly, according to the size of the leak.

38. Should the equalizing piston fail to seat, how can it be known if it is due to dirt on the seat of the valve or leak of the equalizing reservoir pressure?

A. This question was partly answered in the preceding. If there is dirt between the valve and its seat, there will be a constant blow of train line pressure through the angle fitting at all times, but if the piston fails to seat, due to leakage from the equalizing reservoir in the chamber above the piston, there will be no leakage of pressure at the angle fitting with the brake valve handle in full release, or running positions.

39. If there is a continuous blow at the train pipe exhaust port, or angle fitting, what should be done to stop it?

A. If the blow is due to dirt between the valve and its seat, make several service applications and releases. If this does not stop the blow, the valve may be taken apart and cleaned, providing it is known that the trouble is caused by dirt between the valve and its seat. If the piston will not seat on account of leakage from the equalizing reservoir in the chamber above the equalizing piston, or the connections, each connection should be gone over carefully with soap suds to detect and locate the leak, and it should then be taken up. A torch blaze is not sufficient. If it is impossible to stop the leaks, on account of breakage of the parts, etc., a blind gasket may be placed in the connection between the chamber D and equalizing reservoir, plugging this opening, and a plug should be placed in the angle fitting of the train pipe discharge, and braking be done very cautiously and carefully with the valve handle in emergency position. This latter, however, is an expedient that is very seldom necessary.

40. What is the effect of leaving the handle of the brake valve in full release position too long, before returning it to the running position, after releasing brakes?

A. The train line and auxiliary reservoirs will be charged higher than the feed valve is adjusted for, thus permitting the equalization of pressures between the auxiliary reservoirs, train line and main reservoir. Should the handle be then drawn to running position, main reservoir pressure will be unable to pass through the feed valve attachment to the train line until such time as the latter pressure becomes reduced below the point at which the feed valve is adjusted. Should there be leakage in the train line, brakes will apply and drag until the brake valve is thrown to full release position, thus releasing the brakes. The brake valve handle should not be left in full release position after releasing brakes.

41. If, from any reason, the brakes should drag, how can they be released from the engine?

A. If it is found that the train line is overcharged before leaving a terminal, a fairly heavy application of the brake may be made in service position, and the brake valve handle placed in running position. Several repetitions of this process may be necessary. However, if the overcharge occurs while the train is running, and brakes will not release in running position, the valve handle may be placed in full release position and left there until the next stop is made, and then care should be taken to not overcharge again in full release position, but to return to running position in due season, thus preventing this trouble. Sometimes a series of light applications and releases may be made while running to reduce an overcharged train pipe; however, this is not practical on fast, modern trains.

42. If the brakes apply suddenly, what should the engineer do?

A. Place the brake valve in lap position and ascertain the cause. It will probably be due to a burst or parted hose, to the opening of a conductor's valve or the rear angle cock. However, regardless of the cause, the brake valve handle should be placed on lap, to save the main reservoir pressure for releasing the brakes after the train pipe opening has been closed.

43. If the pipe connecting the chamber above the equalizing piston with the equalizing reservoir should be broken off, what should be done?

A. Plug up the connection to chamber D, also the angle fitting on the under side of the brake valve, and brake cautiously and carefully in the emergency application position.

44. What should be done if the pipe leading to the black hand or the air gauge should break? If the pipe to the red hand should break?

A. If the black hand pipe should break, plug the connection at the brake valve, using careful judgment in gauging by sound the amount of pressure drawn from the equalizing chamber in service application. If the red hand pipe should break, plug the connection at the brake valve, taking care that the pump governor is operating and observing that sufficient main reservoir pressure is being accumulated with which to release brakes after each application.

45. How is the train pipe pressure regulated to 70 pounds, while the handle of the G-6 brake is in running position?

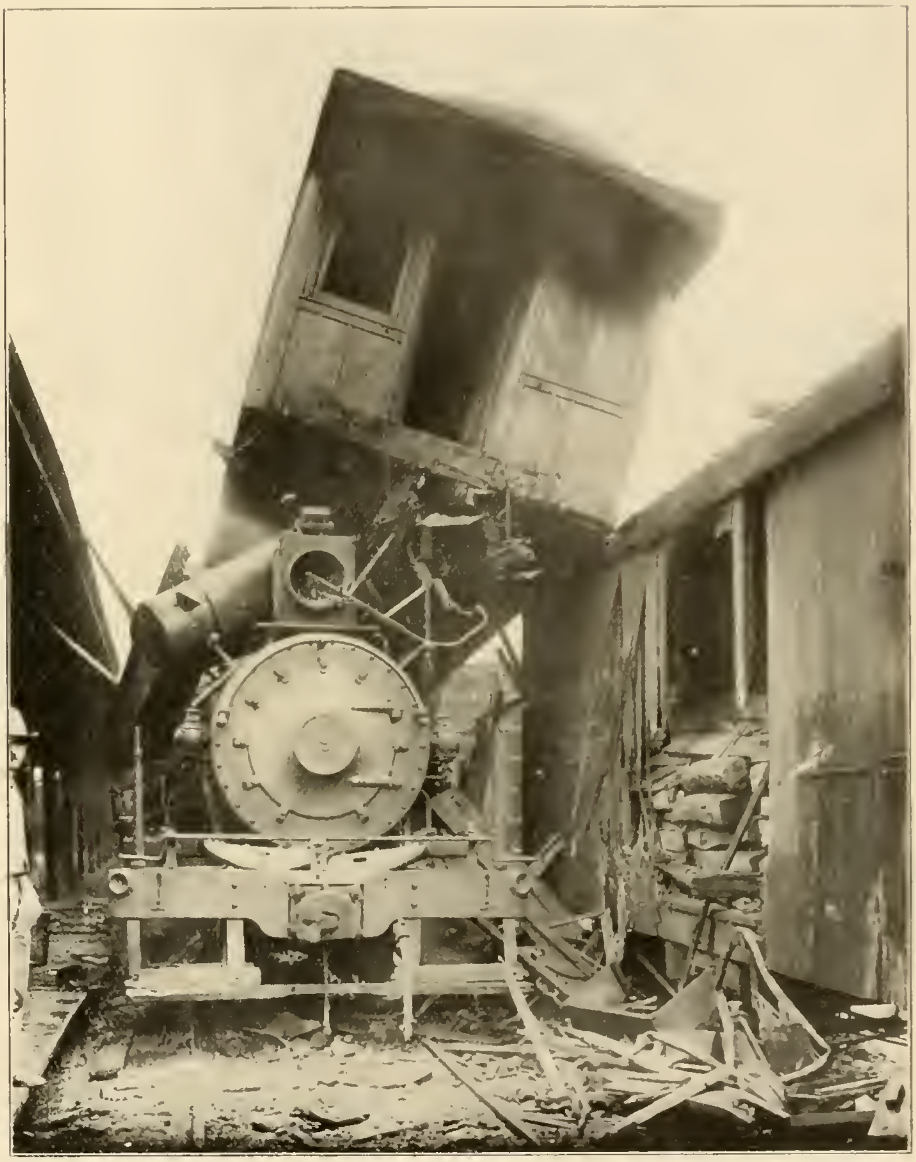
A. By the adjusting nut and spring in the feed valve attachment.

46. What is the reason for having the equalizing reservoir on the brake valve?

A. The equalizing reservoir is used to give an enlarged capacity for the required volume of air pressure on top of the equalizing piston, to permit the equalizing piston to draw pressure gradually from the train pipe in service application. If this enlarged capacity were placed in the brake valve, the valves would be entirely too large and bulky for location in the cab; however, this capacity is obtained by employing a reservoir of suitable capacity, and locating it in a remote and convenient place, and piping it to the brake valve. If the reservoir were not used, and the chamber D capacity was restricted to its present size alone, it would be impossible to reduce pressure sufficiently slow to permit the piston to rise gradually as it now does; but instead, the pressure would be exhausted quickly, the piston would rise suddenly and make a heavier application of the brake than was desired.

47. What effect would a leak from the equalizing reservoir have?

A. It would be troublesome to the engineer inasmuch that he would not be able to control the discharge of train line pressure, as the leakage of pressure above the piston would cause the piston to discharge more train line pressure than he intended and desired; hence, he would be unable to properly control brake applications on his train.



CASE OF RAPID CAR LOADING. IT WENT UP FASTER THAN IT WILL COME DOWN.

48. How can a leak past the packing ring in the equalizing piston be located?

A. Ascertain that the rotary valve and body gasket are tight, place the brake valve handle on lap position and open the angle cock at the end of the tender, thus discharging train line pressure below the equalizing piston. If the black hand now falls, indicating a reduction of pressure in chamber D above the piston, that pressure is evidently passing by the piston into the train pipe and out at the angle cock. Another way is to observe whether the black hand rises when the brake valve has been returned to lap after making a service application. With a long train, a leaky packing ring would permit train line pressure to leak past it into chamber D, which would be indicated by a rise of the black hand on the gauge, during a service application.

49. What danger would there be from a leakage of main reservoir pressure into the train pipe, when the brakes were set and brake valve was on lap position?

A. Such a leakage would increase the train line pressure and cause the triple valves to go to release position, thus releasing the brakes.

50. What danger is there in a leak from the main reservoir to the train pipe when the brakes are released and handle in running position?

A. The train would be overcharged,

and no excess pressure could be carried, if the leakage were of such consequence and there was a considerable lapse of time between brake applications. This unduly increased train line pressure would have a tendency to produce wheel sliding.

51. What repairs may be made on the road to overcome such leakage?

A. It does not pay to make road repairs generally, as frequently more harm is done thereby than good. The four bolts holding together the top and bottom portion of the valve may be carefully tightened, taking care not to break the bolts, and thereby creating a worse condition than existed before. It would be better to exercise unusual care and caution in handling the trouble while on the road, and report it upon arrival at the terminal.

GENERAL Questions Answered

WIRE DRAWN STEAM.

(59) S. S. T., Trenton, N. J., asks:

What is wire drawn steam? A.—Steam to be used with the greatest advantage should be admitted to the cylinders as nearly at boiler pressure as may be. It is not possible to admit it at actual boiler pressure, but the endeavor should be to keep it at high pressure, and, further it should be supplied in such quantity as to follow the moving piston and yet maintain the initial pressure whatever that may have been. If the opening of either the throttle valve or the steam ports is not sufficient to allow the initial pressure to be maintained during the whole period of admission, then the steam is said to be wire drawn. On an indicator card wire drawn steam would be shown by a falling steam line.

FEED VALVE FEATURE ANNULLED, DUE TO OVERCHARGED TRAIN PIPE.

(60) S. R. T., Oswego, N. Y., writes:

Why is it that if you leave the brake valve handle in full release position a little while, and then draw the handle to running position, the brake will go on and won't feed off in the running position, where it ought to feed off, but it will release when you go to full release position again? A.—With the valve handle in full release position, the auxiliary reservoirs and train pipe will charge to the limit the governor is set for, or to maximum main reservoir pressure. When the handle is moved to running position, direct connection is cut off between the main reservoir and train pipe, and another connection is established in a roundabout way through the feed valve attachment; however, if the adjusting spring in the feed valve attachment is regulated to close the feed valve supply valve at 70 pounds, it will close at that pressure and no more pressure from the main reservoir can pass through it to the train pipe until after the train pipe pressure is reduced below 70 pounds, or the amount of the adjusting spring is set for. In the case you mentioned, the running position is virtually converted into a second lap position, and if pressure leaks from the train pipe, the brakes will apply and will not release through the running position, until the train line pressure is reduced below what the adjusting spring is set at. The only way to release will be to go to full release position.

ROUNDHOUSE WORK NOT PROFITABLE.

(61) A. A. I., Utica, N. Y., asks:

If an air pump gives trouble in general, would it not be advisable to replace if you have an extra pump on hand. A.—Yes, in fact, it is better to remove the air pump from the locomotive when needing repairs rather than attempt to make such repairs in the roundhouse unless the needed repairs are exceedingly light. Many roads have adopted the practice of removing the pump from the engine and taking it to the back shop for repairs instead of doing the work on the engine, and decided advantages have resulted from the method. Again, a pump needing repairs in the roundhouse will generally leak steam enough to make it disagreeable for the repairman, who will generally hurry his job and not do it as well as he would if the pump were on the bench in the air-brake repair room.

COLD ROLLED STEEL.

(62) S. S. T., Trenton, N. J., asks:

What is cold rolled steel? A.—Cold rolled steel is practically what its name implies, viz.: Steel which is rolled cold. In general iron and steel shapes are rolled hot and the final rolling is given before the metal has cooled. With cold rolled steel the final rolling is accomplished when the steel is cold.

DIRECT VALVE MOTION.

(63) P. H. O., Woburn, Mass., writes:

Many of the new locomotives having inside admission piston valves use direct motion. Is there any real advantage in using it? Would the indirect motion be just as efficient? Please give reasons. A.—The only advantage of direct over indirect motion is that in the former there are fewer joints or points to produce lost motion from wear, and sometimes a more direct line of force can be secured. Convenience of arrangement, however, often is the first consideration of the designer choosing between direct and indirect motion.

TELEPHONE FOR TRAIN DISPATCHING.

(64) P. H. O., Woburn, Mass., asks:

Is the telephone used alone on any road for train dispatching? If so, is it a success, and what are the disadvantages in using it? A.—The Erie Railroad has been using the telephone for train dispatching and so has the Baltimore & Ohio; other roads have also adopted it. None of them, however, to the absolute exclusion of the telegraph. See article in the current issue of RAILWAY AND LOCOMOTIVE ENGINEERING on the use of the telephone by the Baltimore & Ohio.

RUNAWAY ENGINE.

(65) I. M. S., Biwabik, Minn., writes:

If an engine was going down a mountain light (without a train), without air brakes and the reach rod broke, how could the engine be stopped? A.—We suppose you also mean that the hand brake on the tender were not available. This is one of those questions which supposes everything that an engineer relies upon to be out of commission in the face of extreme peril. This is more of a catch question than a practical one. If the break occurred at a very slow speed, it is just barely possible that engineer and fireman could slip a piece of rope around the end of the lifting arm on each side and take a turn round the handrail and so pull the links up. If speed was at all fast or if the valve gear was heavy it would not be possible to do this. If the engine had old fashioned glands it might, at slow speed, be possible to tighten each gland on one side so as to retard the motion of the piston rods and thus reduce speed. The way you have stated the question leaves practically nothing available to stop the engine with, and we are afraid that under the circumstances nothing could be done to make an effective stop. An engine should not be run on a mountain grade, or anywhere else on the road for that matter, without brakes being in thorough working order and the man running the engine should know beforehand how his brakes are working.

TOO MUCH EMERGENCY.

(66) R. E. H., Sayre, N. Y., writes:

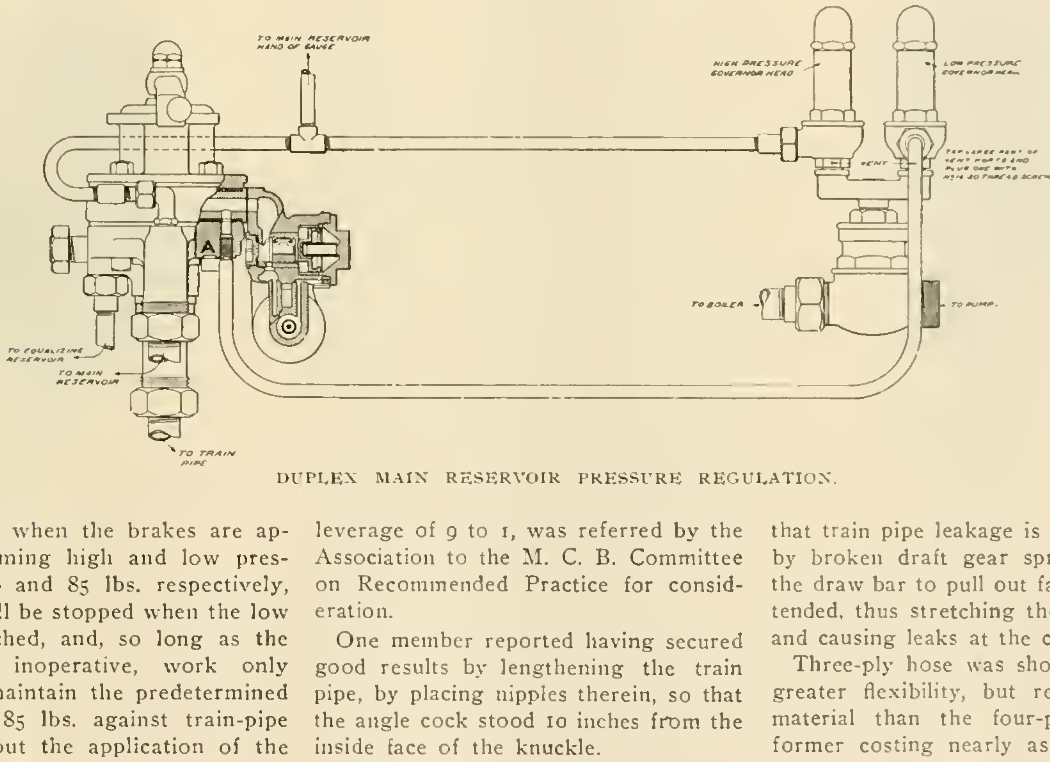
Why do we have so much wear in the bushing which the equalizing piston of the brake valve works in? I find a number of our valves have worn where the ring presses against the bushing, forming shoulders about 1/32 in. high on both top and botom of bushing? A.—This packing ring is purposely made to fit tighter than the ring of the triple valve piston and consequently bears more snugly against the walls of the bushing. The wear, however, is principally caused by the use of the emergency position of the brake valve by the hostler when using the valve around the ash pit, turn table and roundhouse. The dust and dirt from the train pipe is drawn up into the equalizing piston and forms a grinding substance which wears the piston bushing rapidly.

Air Brake Department.

CONDUCTED BY F. M. NELLIS.

Duplex Main-Reservoir Pressure Regulation.

The principal object accomplished by this simple expedient, as illustrated by the accompanying illustration, is the relief of the pump in cases where a high main-reservoir pressure is carried with a view to securing prompt release of brakes on long trains and quick recharge of auxiliaries. In such instances, with a single governor piped as usual, the pump must necessarily work against a high pressure for the greater part of the time; while, with a duplex governor, properly piped, as indicated, the low-pressure head controls, except when the brakes are applied. Assuming high and low pressures of 110 and 85 lbs. respectively, the pump will be stopped when the low limit is reached, and, so long as the brakes are inoperative, work only enough to maintain the predetermined pressure of 85 lbs. against train-pipe leaks, etc., but the application of the brakes by means of the brake valve, cuts in the high-pressure and cuts out the low-pressure head of the governor, and the pump then rapidly builds up a main-reservoir pressure of 110 lbs., thus insuring a more certain and speedy release of the brakes and a prompt recharge of the auxiliary reservoirs. The elimination of stuck brakes and the increased life of the pump are decided advantages, and as already stated, both these advantages may be gained by the substitution of a duplex for a single governor and a rearrangement of the piping.



DUPLEX MAIN RESERVOIR PRESSURE REGULATION.

Echoes of the New Orleans Air Brake Convention.

One member reported that one cup of oil of about three ounces was good for two round trips of about 400 miles.

It was generally conceded by the members that a curled hair strainer for the air cylinder had decided advantages in supplying the pump with clean air.

Some of the members favored the oiling of the curled hair to catch floating dust which otherwise might pass through the dry hair strainer to the pump.

The change from brake beam leverage having a proportion of 5 to 1 to a proportion of 4 to 1 and a maximum total leverage of 9 to 1, was referred by the Association to the M. C. B. Committee on Recommended Practice for consideration.

One member reported having secured good results by lengthening the train pipe, by placing nipples therein, so that the angle cock stood 10 inches from the inside face of the knuckle.

The air cylinder of the pump will require a much less quantity of oil and work more satisfactorily if it is constantly and sparingly fed than if it is intermittently injected in a flood.

The advisability of using a cord connected to the conductor's valve was discussed, and the consensus of opinion seemed to be that in general use, such arrangement would be advisable.

The consensus of opinion, as demonstrated by the discussion, was in favor of the fixed feed form of cup, as substantial objections were found to the adjustable form of feed being tampered with by engineers and roundhouse men.

That the strainer of small diameter quickly clogs and in cold weather freezes, was shown in the discussion, and decided preference was expressed for the strainer of larger diameter and shorter length, which give a slower current of air to the pump, thereby proving a better dust arrester.

Train pipe leakage was believed to be considerably contributed to by the irregular length of train pipe, some pipes having their angle cocks 13 inches back from the inner face of the knuckle, while other angle cocks were located 16 inches back.

The discussion brought forth the fact that train pipe leakage is largely caused by broken draft gear springs allowing the draw bar to pull out farther than intended, thus stretching the hose unduly and causing leaks at the couplings.

Three-ply hose was shown to have a greater flexibility, but required better material than the four-ply hose, the former costing nearly as much as the latter, due to better material being required.

One road located the angle cocks on 5,000 coal cars 14 to 15 inches from the inside face of the coupling. Little trouble from leakage has been experienced, but this is undoubtedly due to greater flexibility of hose than to the distance employed.

Instances were cited where inability to reach the conductor's valve to stop the train had resulted in an accident. Another case was cited where a person lost his life owing to the wrong use of the cord connecting the conductor's valve.

Flexible hose with angle cock 13

inches from inside face of coupling and 13 inches from the center line of car, and turned inward 30 degrees from a perpendicular position (M. C. B.) will give good results. Trouble comes from nonobservance of these rules.

Hand oiling of the air cylinder is at the best intermittent and irregular. At one time there is a flooding of the cylinder with oil, which tends to clog up the ports and valves of the pump; also carry and deposit a sticky gum in the small ports and on the valves of the air pump and governor.

Three members stated that they had already departed from the 5 to 1 recommended proportion to the 4 to 1 proportion. One member stated that he had already equipped 400 passenger cars with this change, and another member reported that he had done similarly with 300 cars. The total leverage had in no case exceeded 7 to 1.

A rubber preservative for air brake hose was mentioned favorably by several members who had tried it. It was considered effective on new hose only, and kept the hose from deteriorating and kept it pliable in winter time. The cost per hose was reported by the manufacturer to be 2 cents, including labor and material.

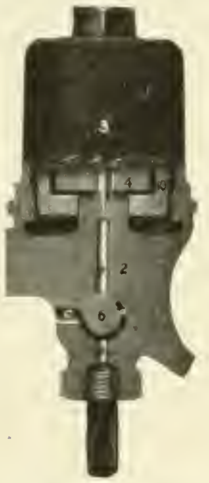


FIG. 1.—HIGH AND LOW PRESSURE RETAINING VALVE.

The discussion brought out the fact that air brake hose of high grade manufacture possesses greater flexibility at all times, and is especially efficacious in cold weather. This is probably due to the better grade of rubber being used and its higher friction test.

The fact was disclosed that the hose nipple is not always screwed into the angle cock properly to allow the faces of the coupling heads to be parallel to each other, thus causing a twist of the hose and leaks at the coupling heads. This reflected much carelessness in installing new hose.

An alarming existence of angle cocks turned outward, instead of inward, was found to exist, and undoubtedly accounts largely for the wear of the hose at the nipple end, as well as to cause a leak at the hose couplings, due to the shortening of the hose.

The discussion demonstrated that the M. C. B. specifications for air hose, if properly followed, would be productive of good hose, both as to flexibility and bursting strength. It was shown, however, that the M. C. B. specifications were frequently ignored by certain roads in the false pursuit of economy.

The discussion demonstrated that the members are thoroughly convinced that hand lubrication of the air cylinder of the air pump is inefficient, and that mechanical lubrication, such as is supplied by the automatic oil cup, has proved its value and is thoroughly satisfactory, efficient and economical.

One member made tests which showed that there was 12 inches to 14 inches play between the cars, due to uneven draft gear and draw bar stresses. This stretched the hose to its extreme limit, badly straining it and partially uncoupling, allowing leakage of train pipe air to escape at the coupling heads.

One member advised that his road was seriously considering the question of eliminating the cord to the signal car discharge valve, that not being an emergency device, and using the cord connected to the conductor's valve and running the full length of the car.

One member called attention to the fact that on many roads the cords connected to the conductor's valve were in such poor condition, and the conductor's valve so tightly closed, that the cord would break when an attempt was made to pull the valve open with the cord.

Spliced air brake hose has proved a failure. The practice either has died out or is dying. One member suggested testing spliced hose with soap suds, and believed that by so doing so many hose would be condemned and returned to the shop that it would stop the practice. The supposedly economical practice, if thoroughly tested, would prove so expensive that it would die a natural death.

A recommendation was made that wherever practical a cord should be used in conjunction with the conductor's valve in passenger cars, the cord running the full length of the car. In cases where it would not be practical to use such a cord, two conductor's valves should be located in the car, one at each end.

One member suggested that possibly the middle portion of the air cylinder was a better point at which to introduce lubrication, this practice seemingly being followed by the large air compressor people; but the discussion brought out the fact that although the cup is located in the middle portion of the cylinder, it actually supplies lubrication direct to the inlet ports of the compressor, thereby introducing it at the end of the cylinder the same as is done with the locomotive air pump.

One of the best papers of the convention was that one introduced by Mr. Geo. R. Parker, advocating a reduction in the standard proportion of the brake beam levers from 5 to 1 to 4 to 1, the objection to the 5 to 1 form being that the movement of the top end of the lever so was great that it would either bottom in the brake beam stout, or strike the end sill of the truck in wearing out a set of brake shoes. The 5 to 1 proportioned brake beam lever, with the average car of to-day gives 16¼ inches top movement of the truck lever, while the 4 to 1 form gives but 13 inches movement for the same lever. The maximum total leverage to be employed was recommended as 9 to 1.

Train pipe leakage was observed to be largely caused by the pulling apart of air brake hose instead of uncoupling them by hand. This undue strain on the hose has a tendency to wrench it at the nipple end and stretch the rubber coating in such a way as to cause it to crack and admit moisture in damp weather, which freezes in cold weather, thus making the hose stiff and rigid. The coupling gasket was also upset, thus causing it to leak. A large amount of train pipe leakage was believed to be due to this evil practice.

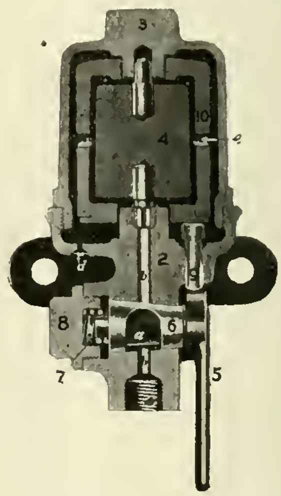


FIG. 2.—HIGH AND LOW PRESSURE RETAINING VALVE.

The disadvantage to which the air brake hose between cars is subjected in cold weather was illustrated by the fact that a test had been made on a 38-car freight train and the total slack found in the train was 17 feet 7⅝ inches. The average slack between the cars was 5.87 inches. The total slack at the knuckles was 4 feet 5.25 inches. The average slack at the knuckles was 1.48 inches. The total slack caused by draw bar end play was 13 feet 2.37 inches. The average slack in draw bar end play was 4.4 inches. These are exceedingly difficult figures for an air hose to operate against in fair weather, to saying of cold weather, when the hose is frozen rigid, destroying its flexibility.

It was the sense of the convention that a brake should be had by which the air brake and hand brake would operate harmoniously.

It was also the sense of the convention that where the slack adjuster is used, the hand brake should be so arranged that the adjuster will take up slack for both hand and air brake.

It was also the sense of the convention that a design of hand brake should develop equal braking power on both trucks.

On a vote of the convention, it was decided to suggest to the Master Car Builders' Association that a change be made in their recommended practice represented in the paper as type 4a, plate 9, in their proceedings, and that the double hand brake be changed.

The officers for the ensuing year were elected as follows: President, L. M

FIG. 3. HIGH AND LOW PRESSURE RETAINING VALVE.

Carleton; first vice-president, W. P. Garabrant; second vice-president, Geo. R. Parker; third vice-president, P. J. Langan; executive members, J. H. Hardy, J. R. Alexander, W. C. Hunter; treasurer, Otto Best; secretary, F. M. Nellis.

From the sentiment expressed, it looked as though the 1906 convention would be held in Montreal, Canada.

High and Low Pressure Retaining Valve.

As is well known, the standard retaining valve is designed to maintain a brake-cylinder pressure of 15 pounds while the auxiliary reservoirs are being recharged, and ordinarily this pressure is sufficient. Under extreme conditions, however, it has proved desirable to have the power of increasing the amount of pressure retained in the brake cylinders during the recharge to 50 pounds, and the Westinghouse Air Brake Co. has met this demand by the manufacture of a high and low pressure retaining valve which fully meets these requirements.

This new retaining valve is very similar to the standard type in general design, but modified as indicated in Figures 1, 2 and 3. It will be noted that the main difference consists in the addition of a cylindrical weight, which surrounds the usual weight and is lifted by it whenever the valve is manipulated to retain 50 pounds. When the handle is placed in the horizontal position, one of two eccentric lugs on it raises pin 9, and also the outside weight, the latter to the top of its movement. During such time the inner weight alone retains the pressure. If the handle is placed in the intermediate position marked "high pressure," (Figure 3), neither eccentric lug touches the lifting pin, and consequently the outside weight rests upon the top of the inner one, and the air pressure must raise both weights before it can escape to the atmosphere. When the handle is placed vertically downward, as shown in the cut, the air passes directly to the atmosphere, thus cutting out the retaining valve, while at the same time the other eccentric lug on the handle raises the lifting pin and outside weight, so that the small weight alone rests on the valve seat, and wear is reduced to a minimum.

It will be noted that the exhaust and low pressure positions of this retaining valve handle are similar to those of the standard retaining valve. This is done so that when cars equipped with this valve are running in localities free from heavy grades, and the train crews may not be familiar with this new type of valve but are so with the standard valve, they cannot by mistake place the handle in the high pressure position. It will be noted also that the letters "H. P." and "L. P." are cast on the body so as to still further assist in indicating the positions of the valve handle.

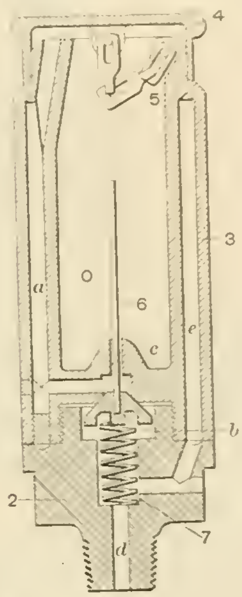
Westinghouse Automatic Oil Cup, No. 2.

As illustrated in the accompanying sketch, the cup is composed of a steel base screwing into the air cylinder of the air pump to which is properly coneted a brass up for holding the oil, on this cup is a cap 4 which fits snugly and is fastened to a three link chain to prevent loss of the cap.

The operation of the cup is as follows: Oil is contained in Chamber *O*. The operative parts consist of a needle feed stem 6, valve *C* and spring 7. On the down stroke of the pump the valve *C* is drawn from its seat by suction compressing the spring 7 and a slight amount of oil is drawn in through the port *a*. On the up stroke of the pump, valve *C* is forced against its seat and closes off all feed of oil which passes along the needle 6 from the pump, thence down to the valve *C*. Thus is will be seen that on each down stroke of the pump oil is drawn past the needle 6, past valve *C* and down through port *a* to the air cylinder. Port *c* is one of a series of heater ports cast in the cup for the purpose of admitting warm air to the body of the cup to keep the oil in a free, liquid state to pass from chamber *O*, past the needle 6 and valve *C* to the air cylinder. As will be noted, the feeding feature of this cup is fixed type and cannot be varied or regulated as can the set screw type of cup known as the No. 1 type.

DON'T USE THE WRONG RING.

(67) R. E. H., Sayre, N. Y., writes: We are using in some of our brake



WESTINGHOUSE AUTOMATIC OIL CUP, No. 2.

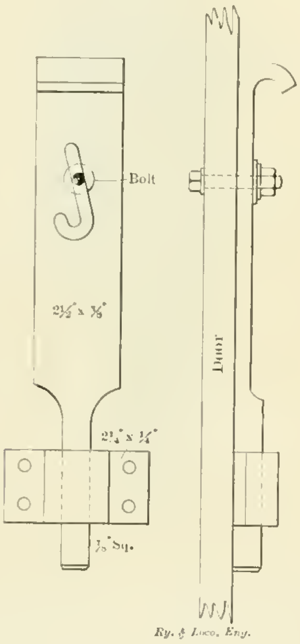
valves a packing ring belonging to the triple valve piston. As they are the same size, would there be any objection to doing this? A.—You will find the width of the packing ring at the split is greater in the equalizing piston ring than in the triple piston ring. When triple piston rings are used for the equalizing piston, it is possible for the air to escape from one side of the piston to the other at the smallest width of the ring, as that point is too narrow for good use in the equalizing piston.

It is stated on good authority that railroads east of Chicago need 60,000 additional freight cars to handle properly business that is coming their way. Half the required number were ordered during the first three months of this year.

Shop Door Lower Bolt.

The sketch which we show here is of the lower bolt for a roundhouse or shop door, and it may be seen in all its glory at the Wilmington shops of the Pennsylvania. The bolt is made out of 2½ x ⅜ in. flat iron about 24 ins. long and turned over at the top so as to be readily taken hold of when it is desired to raise or lower it.

The bottom end of the bolt is ⅞ in. square and passes through a suitable guide and enters a suitable socket in the floor. There is a certain freedom of movement of the upper part of the bolt, as may be seen by the slot cut out which resembles the letter J, with the upright portion somewhat inclined. A bolt or stud with washer remains fastened in the door and the movement of the door bolt is confined to the play of the slot about this fixed peg, if we may so call it. A large flat washer and nut overlap the slot so that the door bolt cannot fall forward or get out of place.



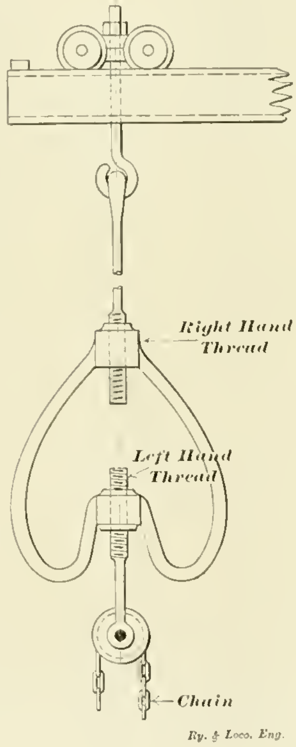
SHOP DOOR LOWER BOLT.

When the door bolt is raised the stud takes up its position in the ball of the letter J, by which of course we mean the slot of that shape. When in that position nothing but intentional and purposive effort will let the door bolt drop down again, and that is a very important point though a seemingly trivial one. Those who have observed the beautiful but destructive curve swept out on the shop floor by a trailing door bolt, and who have experienced the many times such a door will "stall" when being opened or closed, will appreciate this cannot shake-down door bolt.

It is easily made, easily applied, and its maintenance charge may be expressed by the word "nil." Yet it does no damage to door or floor, and if being made in quantity could have the J-slot stamped out in one operation. When in its business place it holds the door tight and close and when out of commission it does not give any trouble, and that is about all that ought legitimately be asked of a door bolt.

Handy Blacksmith's Hoisting Swivel.

A handy hoisting swivel for heavy work is in the blacksmith's shop of the new Pennsylvania Railroad, at Wilmington, Del. The swivel hangs from an ordinary hammer crane and the end of the top link is upset and a heavy square thread is cut on it. The top one is a right hand thread and turns in a nut, from which two stout handles hang down. The handles are like those of a



HOISTING SWIVEL.

loving cup turned upside down. The lower nut turns on a left hand thread, also upset, and from the bottom of this lower link of the whole system hangs a pulley and chain which supports the free end of the work when on the forge.

The reason the handles hang down below the level of the lower nut is the facility which the arrangement gives to the smith or his helper to grasp the swivel at convenient height and raise or lower the free end of frame or bar as part of it lies in the forge fire. The handles are made strong enough to carry the weight, notwithstanding their curved form, and the ends of the two links, as we have called the top and bottom bars, are upset so that larger and coarser threads may be used, thus increasing the lift or fall for every turn of the swivel. The arrangement does not take up much room and does away with the dangling chains and extra rigging necessary where a differential pulley block is used. The whole arrangement is compact and handy, and is very much liked by those who use it, who consider it a great convenience. The swivel can be made of any size and the shape can be modified to suit requirements, but whatever its actual shape it is a time-saver and a convenience to the men.

A Modern Miracle Worker.

Biology is the science of living matter, the study of the origin, structure, development, function and distribution of animals and plants. In the past the students of biology have contented themselves in investigating how animal life has developed through natural or artificial causes or environments, and they learned many interesting and curious things. The story of how the grains that feed the world were cultivated from wild grasses and how our luscious fruits developed by care and selection from wild, tasteless forms, make reading that is more interesting and profitable to rational minds than any work of the imagination.

A miracle worker has arisen in California in the person of Luther Burbank, who in a few years has developed certain plant life through stages that nature and ordinary culture could not achieve in centuries. This wonderful naturalist has affected a revolution in fruit development and has produced absolutely new species of edible fruit, conferring benefits upon mankind such as few men have had the privilege of performing in all the world's history.

The secret of Mr. Burbank's success has been the possession of abnormal powers of observation which he has used to direct the natural tendencies of plants and by proper treatment accelerate to action in a few years that would take centuries for the ordinary processes of growth or development to produce. By observing tendencies of plants that were out of the ordinary, such as scarcity of seeds, absence of thorns, thinness of skin, peculiarities of perfume, and other characteristics he has produced seedless fruit of nearly all kinds, effected a revolution in increasing the scent of many flowers, he has cultivated spineless cactus and intimates that he can convert all the cactus in the plains as free from thorns as a tobacco plant. He has performed many other wonders on plant life, but we consider this one of the most valuable of the marvels performed by Mr. Burbank. Cactus grows where no other plant life will survive, and its leaves make nutritious feeding for animals. It is making the desert more than bloom like a rose, it converts it into a rich pasture where beasts of the field and wild animals may graze in luxury.

Discussing departments of biology is not in our line, but the work of the extraordinary man whose triumphs we have been writing about is a fine example for the thousands of young men beginning to earn their daily bread, who form part of our readers. Two things have contributed to raise Mr. Burbank from obscurity to celebrity, from poverty to affluence. In the first place he was not afraid of hard work, and in the second place he saw into the heart of things as few other persons have seen. All his capital, on beginning business, was industry and observing habits. A field of equal richness is open to every person who will employ the same means.

Lima Switcher.

Our half-tone from the photograph shows a locomotive recently completed by the Lima Locomotive and Machine Company for the United States Navy Yard at Puget Sound.

Class, 0-4-0. Gage, 4 ft. 8½ ins. Weight in working order, 50,000 lbs. Cylinders, 12 x 16 ins. Wheel Base, 6 ft. Driving wheels, 36 ins. diameter. Tires, M. M. Standard, 5½ ins. wide. Axles of steel, with journals 5½ x 6½ ins. Main rods forked rear ends and solid front ends. Parallel rods solid ends and bronze bushings.

All rod oil cups forged solid.

Balanced valves used with a travel of 3¾ ins., ⅝ in. lap and set with 1/16 in. lead in full gear. Crossheads of cast steel, Laird type, with bronze block and side liners. 2¼ ins. piston rods.

Boiler—Type, wagon top, with crown sheet supported by crown bars placed crossways with ends resting on side sheets and braced to dome. Diameter smoke box, 38 ins.; shell, 37⅝ ins. diameter; wagon top, 44 ins.; smoke box, 5/16 in.; shell, ⅜ in.; taper course, ⅜ in.; wagon top, ⅜ in.; backhead, 7/16 in.; throat, 7/16 in.; front tube sheet, 7/16 in.; fire box tube sheet, 7/16 in.; fire box crown, sides and door sheet, 5/16 in.; mud ring, 2 ins. deep, single riveted; water space, front, sides and rear, 2½ ins. Water space, at sides increases at top. Dome, 22 ins. inside diameter; 92 2-in. tubes 9 ft. long; No. 13 B. W. G. Firebox, 40 ins. long by 37⅝ ins. wide at grates. Steam pressure, 150 lbs. Test pressure, 200 lbs. Heating surface—Tubes, 432.25 sq. ft.; fire box, 54.6 sq. ft.; total, 486.85 sq. ft. Grate area, 10.4 sq. ft.

The water supply of 700 gallons is carried in a saddle tank placed over boiler. The tank has an equalizing pipe. The fuel supply of 1,000 lbs. is carried in steel boxes placed on each side of cab under seats.

The grates are rocking and operated from footplate.

The engine has outside equalized steam brake with flanged shoes. The following fittings are used:

Metallic packing. No. 6 Monitor injectors. Ashcroft steam gauge. Two 2 in. Kunkle pop valves. Detroit lubricator. 3 in. Lunkenheimer whistle.

TANK ENGINE BUILT BY THE LIMA LOCOMOTIVE AND MACHINE COMPANY, OF LIMA, OHIO.

When the Interborough Railway Company of New York purchased rolling stock for the Subway lines, steel passenger cars were largely specified, although railroads had but little experience with that material for passenger cars. The cars have proved highly satisfactory, and it seems that a great many will be put in service for surface railways. There is an idea among many travelers that steel makes a car that will be safer in case of accident than a wooden car, especially in case of fire. The New York Central people, it is reported, have ordered 150 all-steel passenger cars that will be employed mostly on their suburban service.

In consequence of the increase of their business, the H. W. Johns-Manville Company have found it necessary to establish more branches as a convenience to customers. The new branches are in the far West—San Francisco, Seattle, Kansas City, Los Angeles, Little Rock, and Minneapolis. With these, in addition to the old branches, New York, Milwaukee, Chicago, St. Louis, Boston, Philadelphia, Pittsburg, Cleveland, New Orleans, London, Paris and Brussels, the company has now eighteen branches, covering the entire United States and Europe.

Very flattering reports have been made from time to time about the performance of the locomotives on the Chicago and North Western with the Young valve gear. The North Western people have ordered a big lot of locomotives, but we notice there is no Young valve gear specified for any of them.

Fitting a Driving Box.

BY JAMES KENNEDY.

One of the most valuable features of Railway and Locomotive Engineering is the multitudinous variety of "shop hints" published in its columns—hints of much value to the earnest mechanic or engineer who aspires to a wide knowledge of his calling. In the larger machine and railroad shops, where the modern tendency to keep workmen constantly occupied at some branch of work in which they have had special experience there is a tendency to develop a spirit of secretiveness not calculated to educate an apprentice or to broaden the experience of even the most skilled among the workmen.

Of these tricks of the trade there is no end. Most of them appear trivial at first sight, and might be deemed not sufficiently important to warrant a demonstration in a mechanical journal. Most of these little tricks, however, have in them some mechanical principle embodying a simple method of producing some important effect and may be applicable on relative conditions on a larger scale. Among a certain class of the knowing ones these trade secrets are carefully guarded. There is a degree of self-complacency about the possessors of these trade secrets which, to their minds, seems to make up for the lack of education or mechanical training and tends to make up for their shortcomings in the several branches of the trade.

It is worthy of remark, however, that the most accomplished mechanics are, as a rule, the most communicable, and are ever ready not only to instruct their fellows what to do but also what to avoid, and a better illustration of the truth of this statement could not be given than the account of the fitting of a driving box by a machinist named Tracy. Twenty years have elapsed since there was any trace of Tracy. He may know more by this time. He could hardly know less. There was a rush on driving boxes and Tracy was sent to help them out. The leading hand, a skilled and gentlemanly workman, volunteered some instructions to Tracy, but Tracy waved him aside with the assurance that he, Tracy, had not come here to learn anything. Tracy knew it all. Four boxes were given to Tracy. The size was of the smaller kind, and it was not unusual to have a similar set fitted to the axles in two hours. Tracy began operations as soon after 7 A. M. as he could get his new files and hammer and paint pot and brush together. At 11.30 he had succeeded in adjusting the interior of one of the four boxes to the curvature of the axle upon which it was intended to bear. The discovery was made, however, that the cellar previously fitted to the bottom of the box would not look at the box. Tracy had indulged in the foolish practice of hammering the top of the driving box every time before trying it on the axle. He had done this in order to loosen out of the oil holes and oil ways on the top of the box any filings or other particles that his brush had failed to remove, with the result that the hundreds of blows struck upon the top of the box had the effect of stretching the metal in the upper part of the box and consequently closing the box at the bottom. The most remarkable thing about the performance was how Tracy had managed to get ahead of himself. There doubtless is a gradually decreasing limit to the effect on a driving box by hammer blows such as were struck by Tracy, or perhaps, discovering that his filing had no apparent effect upon the fitting of the box, he grew desperate, and by giving a double dose of filing he gradually drew ahead of the game. Great globules of sweat on the brow of the bewildered Tracy and a couple of pounds or more of bronze dust on the floor showed that he had not been idle. There was, of course, nothing else to be done with the box under such circumstances but to plane it parallel again and line the wedges to suit the reduced size of the box.

The correct practice before fitting driving boxes is to place corks in the oil holes leading from the top of the box and thus obviate the necessity of hammering the box for the purpose of loosening the adhesive filings; nevertheless there are few evil practices so common in railroad shops as the hammering of driving boxes to jar the filings from their lurking places.

Two classes of boxes are especially in danger of being treated to this method, the smaller size of boxes which are light enough to be lifted by hand, and those of the largest size that are raised by some mechanical appliance and dropped on the axle in the process of fitting. In the case of both the final act before lifting them to the axle is to set them square up on their bases, and it is at this time that the man with his hammer gets in his work. Much of the trouble with driving boxes might be traced to the ignorant abuse which the boxes are subjected to in the process of fitting. In the case of a cast iron box with separate brass bearing the danger is greater than in the case of the solid brass or bronze box, for it will be readily seen that no matter how carefully fitted the brass bearing may be into the cast iron box, or how tightly it may be driven to its place at such fitting, the constant repetition of hard hammer blows upon the top of the box cannot fail to affect the fitting of the brass and consequently to loosen the bearing in its place, or the box itself becoming prematurely crystalized, or even cracked, so that it is ready to break in pieces after a short period of service.

While the latter class of box continues in service it would be well to remember that in view of the fact that all driving boxes have a tendency to close up when bored out, it would be well in the class referred to that the scale at least be bored out of the bearing before being fitted into the box. In the case of the one-piece bronze box it is not necessary for the reason that its solidity affords an opportunity to reverse the method of Tracy and if the box has closed to such an extent as may render it difficult to adjust the cellar, the box may be readily expanded by adjusting a steel bar on "drift" into the oil way in the inner crown of the box and a few vigorous blows with a hand hammer on the "drift" will have the effect of reopening the box to its normal or parallel position. This is one of the trade secrets to which the oil way or groove in driving boxes adapts itself so that hammer marks are not necessarily or needlessly visible.

In view of the preceding, it need hardly be said that all chipping on the top of the box, particularly on solid boxes, and all fitting of saddles and cutting of oil ways should be done before the box is fitted to the axle. Indeed, it is positively essential to good fitting that the careful adjustment of the bearing to the axle should be the last operation in the general fitting of a driving box.

Champion Tramp.

Ned Kishman, alias Texas Ed, alias Brake Rod, alias Cinders, alias Globe Trotter Ted, the tramp who has been arrested in more countries than any man on earth, is back in Chicago.

Kishman, who has carved his name on railway stations all over the world, has established a record of being incarcerated for vagrancy in the jails or prisons of 47 different countries.

He has lost count of the number of times that he has been arrested, but declares that he has viewed over 1,400 different prisons from the viewpoint of the man inside. He has looked through the bars upon the cities of the world, and claims having traveled over 233,485 miles without paying a cent of railway fare.

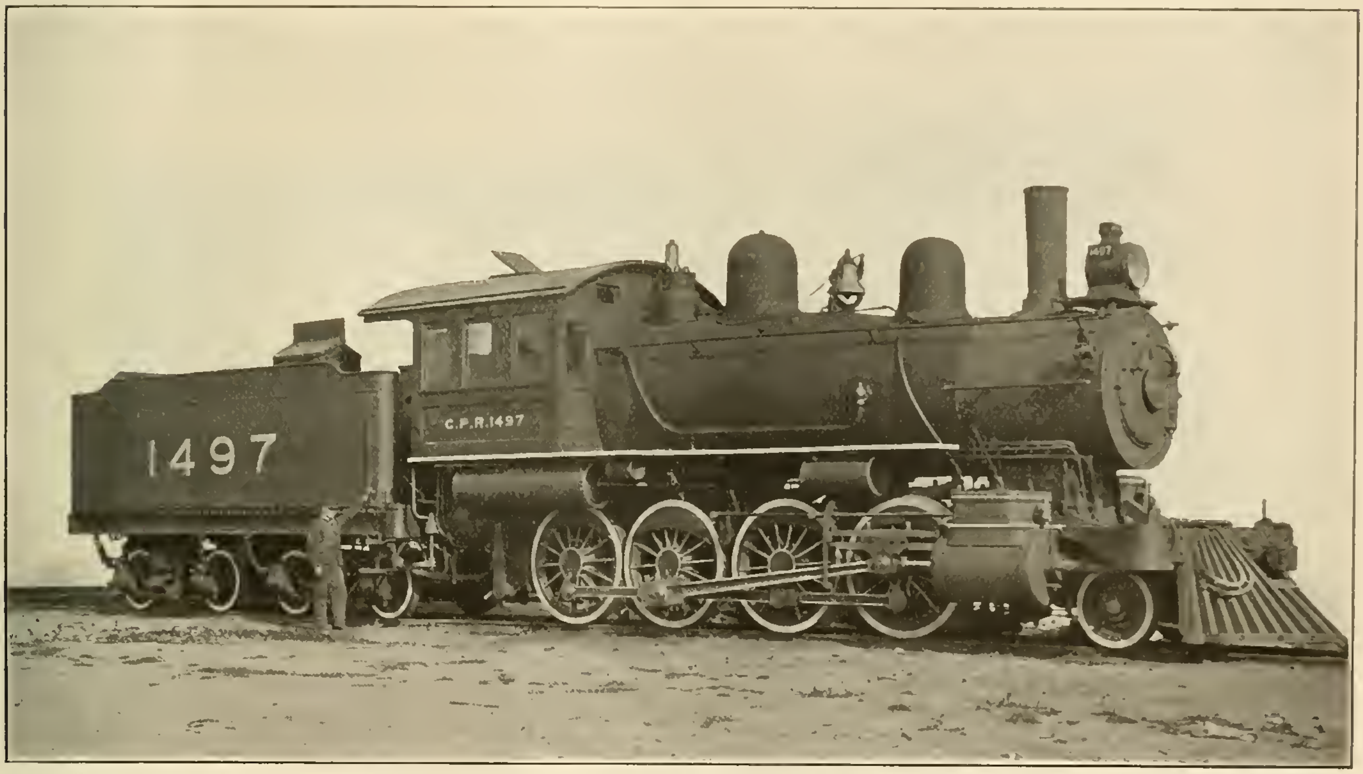
He boasts that the only railroad fare he has ever paid was from Hot Springs, Ark., to Malvern Junction, approximately 35 miles, when he was too ill to attempt to beat that road. And he figures that, had he paid first class fare for all the riding he has done, he would have spent $572,858.

The man who has kept over half a

million dollars out of the pockets of shareholders in railways is a small, lithe, bronze man, probably 43 years of age. He was born in Clinton county, O., near Wilmington, and ran away from home at the age of 15. He has visited practically every country on the globe and every district of the United States since then, and once came within three miles of his home, which he saw through a blur of cinders while riding on the trucks of a through express train.—Hamilton, O., *Democrat*.

Compound Consolidation for the Canadian Pacific.

Some heavy compound consolidation engines have recently been built for the Canadian Pacific Railway by the Canada Foundry Company, Limited, of Toronto, Ontario, of which Mr. John Harkom is superintendent. These engines are the first which have been built in that city since about 1853; at that time the "Toronto" was turned out of the shops of James Good, and was run on the Ontario, Huron & Simcoe Railway. This old-timer was illustrated on page 157 of the April, 1905, issue of RAILWAY AND LOCOMOTIVE ENGINEERING.



CANADIAN PACIFIC RAILWAY CONSOLIDATION LOCOMOTIVE.
H. H. Vaughan, Supt. of Motive Power (Lines East). Canada Foundry, Builders.

The consolidation engine which we here illustrate has cylinders 22 and 35x26 ins. The driving wheels are 57 ins. in diameter and the weight carried upon them is 144,800 lbs. The total weight in working order is 164,000 lbs., thus there are 19,200 lbs. on the pony truck in front. The main valves are balanced slide and are driven by indirect motion. The main driving wheels are the third pair and these wheels and the pair in front of them have no flanges on their tires.

The total wheel base of engine is 23 ft. 6 ins., and the driving wheels base is 14 ft. 10 ins. The spacing of the wheels is as close as it can be. The two flat tired wheels are kept apart far enough to give the rocker box room between them, and the first and second pair of drivers and the main and rear pair of drivers are as close together as flanged and bald tires can be placed. The pony truck, the first and second drivers are equalized together, the drivers having overhung springs. The main and rear drivers are equalized together with driving box equalizers. There is one semi-elliptic spring between the wheels and a nest of coil springs at the outer ends of the equalizing system.

The boiler is radial stayed and of the straight top type. It carries a steam pressure of 200 lbs. to the square inch. The diameter of the boiler at the smoke box end is 5 ft. 3/4 in. The flues, 254 in number, 2 ins. outside diameter, and are 12 ft. 10-9/16 ins. long. The heating surface derived from these tubes is 1,710 sq. ft., and when the 166 sq. ft. derived from the area of the fire box walls is added, it gives a total heating surface of 1,876 sq. ft. The grate area is 32 sq. ft. The fire box is 9 ft. 1 7/8 ins. long by 3 ft. 6 5/8 ins. wide. As the crown sheet slopes toward the back the depth of the fire box varies, though the mud ring is level, the depth at the front is 5 ft. 6 1/4 ins. and 5 ft. 1 1/4 ins. at the back. The inside diameter of the dome is 2 ft. 3 1/8 ins., while the opening into it from the boiler is 1 ft. 8 ins. diameter.

The tender frame is made of structural steel and is according to the railway company's standard. The tank is of the ordinary U-shaped type and holds 5,000 Imperial gallons, and 10 tons of coal is the fuel load. Altogether the engine is a good example of heavy freight power.

Short Hours for Machines.

"When men complain about their hours of labor," said a railroad superintendent the other day, "they are wont to exclaim that they have to work like machines. Now, do you know that is a very fallacious comparison, for few machines are worked more than eight hours a day, and the locomotive, the crowning glory of mechanism, to my mind, seldom does more than five hours' work a day.

"This fact struck me when I saw the other day that the locomotives of the Pennsylvania Railroad made an average record of 32,480 miles each last year, or less than 100 miles a day, while the average run of the New York Central locomotives was 38,831 miles, and the Wabash headed the list with

42,670 miles, while Lehigh Valley engines covered only 25,883 miles each.

"So it means it isn't so bad to be a locomotive."

Side Dump Ore Car.

The El Paso & Southwestern Railroad are using a side dump ore car, built by the Pressed Steel Car Company, of Pittsburgh, which has given every satisfaction.

The car measures 9 ft. from the top of the rail to the top of the body, and inside length of body is 30 ft. 3/4 in. Over the end sills the car measures 31 ft. 6 ins., and inside it is 8 ft. 6 ins. wide. The extreme width over stakes is 9 ft. 11 ins. When the contents are leveled off even with the top of the car, its volume capacity is 980 cubic feet, and with an average heap of 10 ins. the cubic contents may be made to go as high as 1,193 cubic feet.

The car is made in four compartments in order that the body may have some sort of cross bracing inside, as the series of four doors along each side does not give the car any lateral stiffness. What may be called the coping, or portion above the door, is one solid side piece, to which the partitions are fastened.

The doors may be opened all together or one at a time. Each door is equipped with an air cylinder, the operation of which does the work of opening and closing the doors. The total door opening when all four are lifted is, length 14 ft. 6 ins., and width 3 ft. The dead weight of the car body is 27,860 lbs., while that of the trucks is 15,340 lbs., thus giving a tare of 43,200 lbs. The maximum load is 110,000 lbs.

These figures are interesting, as they show that ratio of paying load to dead weight hauled is 71.8 per cent. This is one of the advantages possessed by all the family of steel cars. The ratio of load to tare is always high, ranging between 70 to 80 per cent., and this desirable state of affairs is attained with an increase of durability of the cars themselves and a decrease of the maintenance charge where fair usage is the rule.

SIDE DUMP ORE CAR OF 100,000 LBS. CAPACITY.

Everything Doing Business at the Old Stand.

The good old horse is a familiar animal. We do not mean by this that he is at all unduly familiar in his behavior to the human race, we mean that his form, his gait, whether parallel or diagonal, his speed and his work are all matters of fact with which we are familiar, yet the non-technical press of the country have sadly bidden him good-bye on many occasions.

In the good old days, when the locomotive had struggled into the daylight, the prediction was made that it would soon oust the horse. Yet for generations we have been familiar with the sight of that intelligent quadruped drawing men, women and children and tons of merchandise to and from the railway station. Instead of turning him out to grass, the locomotive gave him a lot more to do.

When the bicycle family, with tinkling bell, came down the dusty road at a wholly fictitious price, the "good-bye" press of the land said the horse was a gonner this time for sure; but the horse kept jogging along as if nothing had happened, and he is a good representative of middle of the road party to-day.

Later on the automobile tooted its way into the public eye, and the "Farewell" press called sadly for the curtain to be rung down on the noble steed and the money to be given back from the box office, but the curtain jambed in the proscenium arch and the spot light still reveals the horse doing considerable business somewhere near the old stand.

While the horse was being left alone for a few minutes, the modest trolley car came out of the barn, with the tall chimneys of the electric power house as a background. It was somewhat longer and heavier than the old horse car but it had more straps for you to hang on by, and horse, bicycle and locomotive were told of the writing on the wall which the "Belteshazer" press alone could, and did, interpret to its own satisfaction.

Finally the electric locomotive came forth, and the "We-told-you-so" press requested the steam locomotive to get well in to clear on the side track before it got smashed, or advised it to examine the scrap heap for a soft place to fall. But the steam locomotive puffed on up the main line with a good sized train on a long haul, and is expected to keep on doing it for several weeks to come. We do not say that improvements cannot come which will alter existing conditions, but we do say that the change will be so gradual when it comes that a formal farewell is rather apt to be too previous, and that a healthy view of the past workings of the law of evolution is a very good thing to apply to present-day conditions.

The Locomotive Does the Rest.

A little boy was drawing the picture of a locomotive on his slate. His father, becoming interested, asked what the object was. The boy replied that it was a locomotive. Then the father said:

"Why don't you draw the cars, too?"

The boy hesitated and slowly replied:

"Papa, the locomotive draws the cars."—Philadelphia *Times*.

French words, it is said, are better adapted to the telephone than English words. The large number of sibilant or hissing syllables in English renders it a less easy and accurate means of communication.

Of Personal Interest.

Mr. F. L. Fox has been appointed general foreman of the Pere Marquette at Ionia, Mich.

Mr. J. F. Mann has been appointed general foreman of the Pere Marquette at Saginaw, Mich.

Mr. Charles O'Toole has been appointed roundhouse foreman on the Northern Pacific Railway at Livingston, Mont.

Mr. D. McKinley has been appointed general foreman of the car department of the Pere Marquette, at Muskegon, Mich.

Mr. George Wilson has been appointed roundhouse foreman on the Evansville & Terre Haute Railroad at Evansville, Ind.

Mr. J. H. Crane has been appointed superintendent of the Northern division of the Colorado & Wyoming, with headquarters at Sunrise, Wyo.

Mr. R. C. Morrison has been appointed superintendent of the Knoxville division of the Louisville & Nashville, with office at Knoxville, Tenn.

Mr. F. W. Cooper, heretofore with the Atlantic Coast Line, has been appointed master mechanic of the Lehigh Valley at East Buffalo, N. Y.

Mr. O. B. Johnson has been appointed train master of the North-West division of the Chicago Great Western Railway, vice Mr. Geo. Reith, promoted.

Mr. C. S. Sims, formerly general manager of the Baltimore & Ohio, is said to have accepted the position of assistant to the president of the Erie.

Mr. John Scott has been appointed general foreman at Vancouver, B. C., shops of the Canadian Pacific Railway, vice Mr. F. E. Hobbs, transferred.

Mr. W. Z. Davis has been appointed acting superintendent of the Bonanza district of the Missouri & Louisiana, with headquarters at Bonanza, Ark.

Mr. J. J. Kelker, general foreman of the Cincinnati, Hamilton & Dayton shops at Lima, Ohio, has been appointed master mechanic at Dayton, Ohio.

Mr. John H. Riegel has been appointed trainmaster for the Trinidad-New Mexico division of the Colorado & Southern, with headquarters at Trinidad, Col.

Mr. Harry McBeth, roundhouse foreman for the Nickel Plate, at Buffalo, has been appointed master mechanic at Conneaut, in place of Mr. Miller, advanced.

Mr. Frank T. Lally has been appointed traveling passenger agent of the Chicago, Burlington & Quincy, at St. Paul, Minn, to succeed Mr. A. L. Eidemiller, resigned.

Mr. Raymond Du Puy, late general manager of the St. Joseph & Grand Island, is now general manager of the Tidewater Railway, with headquarters at Norfolk, Va.

Mr. W. C. Fordyce, president of the Little Rock & Hot Springs, has been appointed general superintendent of the Pine Bluff & Western, with headquarters at St. Louis, Mo.

The headquarters of J. O. Crockett, superintendent of the Southwestern division of the Chicago, Rock Island & Pacific, have been removed from Kansas City, Mo., to Topeka, Kan.

Mr. E. T. White, superintendent of motive power, has had his jurisdiction extended to include the Pittsburgh System of the Baltimore & Ohio Railroad, with office at Baltimore.

Mr. Henry C. Robinson, assistant division superintendent of the Boston & Maine, has been appointed superintendent of the Boston division, with headquarters at Boston, Mass.

Mr. Frank Burke has been appointed traveling engineer of the Duluth, Misabe & Northern. Mr. Burke has had many years of experience as an engineer on different roads.

Mr. W. Connolly, formerly trainmaster of the Oregon Railroad & Navigation Company, has been promoted to assistant superintendent of the Washington division of the same road.

Mr. George Sutherland has resigned as general traffic manager of the Great Northern Steamship Company, which operates a line of steamers between Seattle, Wash., and the Orient.

Mr. L. S. Cass, president of the Waterloo, Cedar Falls & Northern, has been appointed assistant to the general manager of the Chicago Great Western, with office at St. Paul, Minn.

Mr. George Hay, formerly general roundhouse foreman at West Albany, on the New York Central, has been transferred to Oswego shops of that company, holding a similar position.

Mr. D. S. More, heretofore trainmaster of the Mexican Central at Monterey, Mex., has been appointed assistant superintendent of the Chihuahua division, with headquarters at Chihuahua, Mex.

Mr. Edward Heck, locomotive foreman on the New York Central at Mott Haven, N. Y., has been transferred to the West Albany roundhouse on the same road, vice Mr. G. Hay, transferred.

Mr. C. H. Sheridan, formerly division storekeeper at the West Albany shops of the New York Central, has been transferred to the Mott Haven shops on the same road, vice Mr. Greenhalgh, transferred.

Mr. W. L. Greenhalgh, formerly storekeeper at the Mott Haven shops of the New York Central, has been transferred to the West Albany shops of the same road, vice Mr. C. H. Sheridan transferred.

Mr. W. H. Knowlton, principal assistant engineer of the New York Central & Hudson River, at Syracuse, N. Y., has been transferred to New York to assist Vice-President Wilgus in the work of electrification.

Mr. George T. Ross, heretofore general inspector of station service of the Chicago, Burlington & Quincy, has been appointed general superintendent of the Iowa district of that road, with headquarters at Burlington, Iowa.

Mr. John R. Michaels, heretofore assistant superintendent of the Minnesota division of the Minneapolis, St. Paul & Ste. Marie, has been appointed superintendent of the Winnipeg line, with office at Glenwood, Minn.

Mr. D. W. Dinan, heretofore assistant superintendent of the Pennsylvania division of the New York Central & Hudson River, has been appointed superintendent of the same division, with headquarters at Corning, N. Y.

Mr. A. J. Alexander has been appointed superintendent of the Illinois division of the St. Louis, Iron Mountain & Southern, with headquarters at Chester, Ill., and the office of the assistant superintendent is abolished.

Mr. O. A. Fisher, formerly on the Chicago division of the Atchison, Topeka & Santa Fe Railway, has been appointed road foreman of engines on the Southern Kansas division of the same road, with office at Chanute, Kan.

Mr. H. C. Van Buskirk, general master mechanic of the Ft. Worth & Denver City, has been appointed superintendent of motive power of the Colorado & Southern, with headquarters at Denver, Col., to succeed Mr. A. L. Studer, resigned.

Mr. H. C. Nutt, general superintendent of Iowa district of the Chicago, Burlington & Quincy, has been appointed general superintendent of the Missouri district, with headquarters at St. Louis, Mo., to succeed Mr. Henry Miller, resigned.

Mr. Alexander Kearney, who recently resigned as superintendent of motive power of the Baltimore & Ohio, at Pittsburgh, has been appointed assistant superintendent of motive power of the Norfolk & Western, with headquarters at Roanoke, Va.

Before retiring from the position of general manager of the Atchison, Topeka & Santa Fe to accept the second vice-presidency of the Chicago, Rock Island & Pacific, Mr. H. U. Mudge was presented with a handsome silver service by his associates on the first-named road.

Mr. R. K. Smith, as superintendent of the Missouri division of the St. Louis, Iron Mountain & Southern, has been given supervision of the transportation service of that company over the St. Louis & Southwestern Railway, between Dexter and Illmo, Mo. His jurisdiction over the Illinois division is withdrawn.

Randjit M. Singh, a high caste Hindu, is working at the present time in the Baldwin Locomotive Works to perfect himself in the practical side of the business which has made Philadelphia famous the world over. When he has learned the business properly it is his intention to return to India, where he expects to establish locomotive works.

It is officially announced that Mr. R. K. Smith, superintendent of the Missouri division of the St. Louis, Iron Mountain & Southern, will have supervision of the transportation service of that road over the St. Louis Southwestern between Dexter and Illmo, Mo., and that his jurisdiction over the Illinois division of the Iron Mountain is withdrawn.

Mr. Fred S. Wilcoxen, formerly an engineer on the Toledo, St. Louis & Western, or Clover Leaf Route, has been appointed division master mechanic of the St. Louis division of that road, with headquarters at Charleston, Ill. Mr. Wilcoxen has jurisdiction over the Madison terminal, also over the engineers and roundhouse staffs, together with the car department.

Mr. W. S. Kinnear, chief engineer of the Michigan Central Railroad, has been made assistant general manager in addition to his engineering duties. Mr. Kinnear has enjoyed a varied experience in the pursuit of engineering work, and is one of the ablest civil engineers in the country. If he succeeds as well in the operating department, higher offers will soon come to him on the Vanderbilt System.

Mr. J. A. Edson, general manager of the Cincinnati, Hamilton & Dayton, has been selected to succeed Mr. Stuart R. Knott as president of the Kansas City Southern. Mr. Edison has been general manager of the Cincinnati, Hamilton & Dayton since October 15, 1904, previous to which date he was for over five years general manager of the Kansas City Southern. From June 1, 1893, to June 25, 1899, he was general superintendent of the St. Louis Southwestern.

Mr. William K. Vanderbilt, Jr., whose name is particularly familiar the world over through his activity as an automobile racer, is settling down to railroad business, and is acquiring a practical knowledge which will enable him to take part in the management of the system dominated by his family. We expect that Mr. Vanderbilt will display as much energy in railroad management as he did in racing automobiles, and that it will bring him fame of a more substantial kind.

Mr. E. A. Miller, division master mechanic of the New York, Chicago & St. Louis, at Conneaut, Ohio, since 1882, has been appointed superintendent of motive power of that road, with headquarters at Cleveland, to succeed Mr. W. L. Gilmore, resigned. Mr. Miller is one of the ablest shop managers in the country, and has had several invitations to take a higher position on other roads, but he stuck faithfully to the Nickel Plate, and thoroughly deserves the advance which he has received.

Mr. A. J. Alexander has been appointed superintendent of the Illinois division of the St. Louis, Iron Mountain & Southern Railway. He will have jurisdiction over train, yard and station service between Bixby and Thebes; Gorham and Bush; Bush and Herrin, and Bush and Zeigler, and supervision of the transportation service of this company between North Junction, Ill., and Illmo, Mo., over Thebes Bridge, with office at Chester, Ill. The office of assistant superintendent of the Illinois division is abolished.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company the old board, consisting of Edward F. C. Young, John A. Walker, Edward L. Young, William Murray, George T. Smith, Joseph D. Bedle and George E. Long, was unanimously re-elected. The board of directors re-elected the former officers, namely, Edw. F. C. Young, president; John A. Walker, vice-president and treasurer; George E. Long, secretary. Judge Joseph D. Bedle was also re-elected as counsel. The stockholders present expressed themselves as thoroughly satisfied with the management of the company by its officers.

At the semi-annual meeting of the Locomotive Engineers' Brotherhood of the New York Central, held at Syracuse last month, Grand Chief Stone was the guest of honor, and he made a strong address to the engineers. He emphasized the need of labor carrying out all of its agreements with capital. Mr. Stone says that the Brotherhood is growing at the rate of 350 members per month. The total membership is 50,000. Ninety per cent. of the enginemen in the country are in the order, which has insurance and other benefits.

We are considerably bothered by correspondents asking us for information about how to obtain employment on the Panama Canal, and what the rates of pay are likely to be. To all such people our advice is, stay at home and attend to business. Panama is a poor place to go to at the best, and there are very few people who cannot do better in the United States than they can do in any part of Central America. We noticed that a group of gentle laborers such as clerks and others of that class that have secured employment in Panama, came away in a panic lately, because they heard the expression "yellow fever" mentioned. A person to make a success in a country like Panama needs to be possessed of the grit which the fugitives from yellow fever seem to be very deficient of.

A steel mail car belonging to the Erie Railroad, which was exhibited at the International Railway Congress meeting at Washington, attracted a great deal of attention from foreign visitors and others. The cars were considered almost perfect in conveniences designed for facilitating the work. Mr. F. D. Underwood, president of the Erie Railroad, is credited with giving valuable suggestions in relation to the building of these cars.

The Legislature of the State of Missouri has passed a bill which, if it becomes a law, will make it compulsory for all the railroads of that state to install the block signal system. The penalty for failure to comply promptly with the law will subject the delinquent road to a fine of $100 a day. This money to be paid to the school fund of each county through which the road passses.

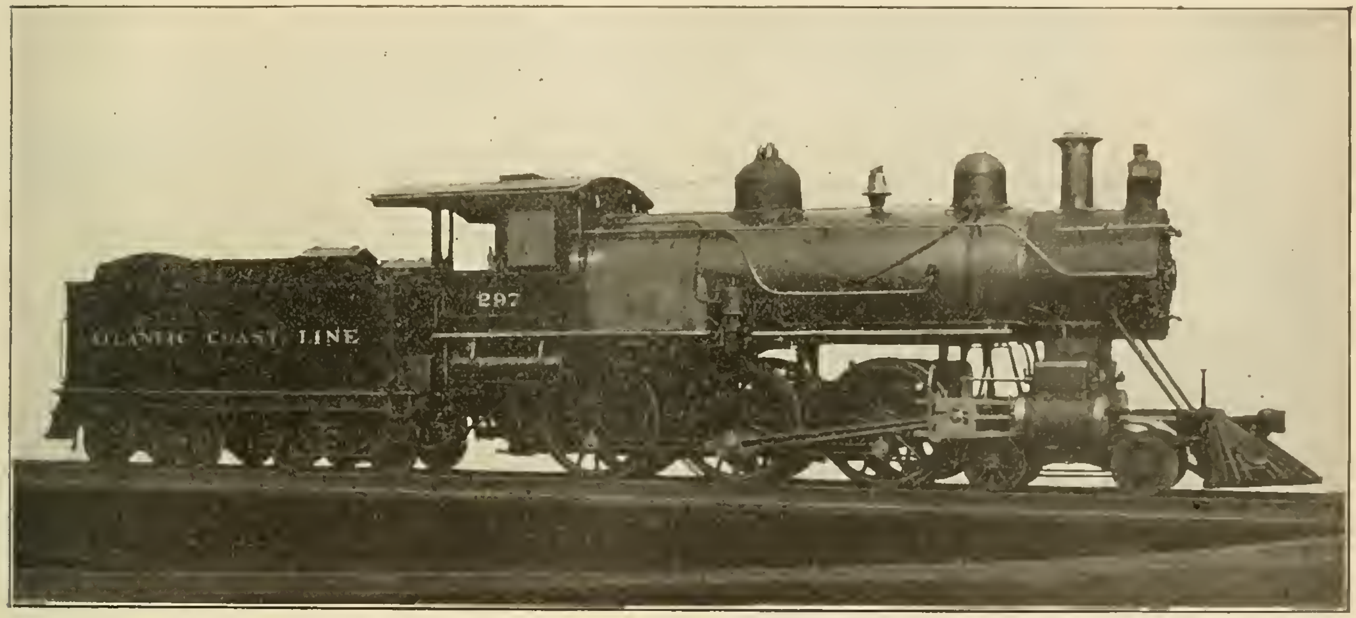
Mr. G. W. Fitzsimmons has been appointed general boiler inspector of the Erie system, a position rich with possibilities for good when well filled.

Of the 136,561 freight cars ordered for American railroads last year 65,000 were of steel construction.

A Manly Circular.

Mr. F. A. Delano, the well known railroad official who went up through the mechanical department to be general manager of the Chicago, Burlington & Quincy Railroad, has now been appointed first vice-president of the Wabash, as we intimated in our last issue. Mr. Delano has introduced a novel practice in taking hold of the management of the Wabash by issuing a sort of personal circular to the employees, which is one of the most manly productions we have read for some time. It reads:

"In the nature of things I cannot meet you all immediately, although it will be my earnest effort to become acquainted as rapidly as possible with the employees of the Wabash as well as with the property itself and the communities along its lines.



ATLANTIC COAST LINE EXPRESS ENGINE.

Mr. J. S. Chambers, Superintendent Motive Power. Baldwin Locomotive Works, Builders.

"As it may be days or weeks before I meet many of you, I wish to express this foreword of greeting and good cheer.

"I come to the Wabash with the earnest determination to make the most of the opportunity to develop its magnificent resources. I do not expect to do this alone, but only with the co-operation and hearty good will of all. It shall be my endeavor to recognize energy and zeal in the service, and as I get better acquainted, to make no outside appointments where there are available men in the service competent to fill those positions.

"The Wabash has developed rapidly in recent years, and unless we get a serious set-back in the way of hard times there will be ample opportunities for me to recognize ability, energy and loyalty and to reward it with adequate promotion.

"By hearty co-operation of all departments we shall make our work more agreeable and less arduous, and finally we shall have a thorough satisfaction in working together in a harmonious manner, and let us hope, on a well-managed and successful railroad—one we can all be proud of."

Atlantic Coast Line Passenger.

Not long ago the Atlantic Coast Line Railroad procured some good ten-wheel passenger power from the Baldwin Locomotive Works, of Philadelphia. Our illustration shows the engine as she left the builder's shops.

The engine is simple with 20x26 in. cylinders and 68 in. driving wheels. All the wheels are flanged, the drivers are equally spaced, being each 81 ins. apart. The main valves are balanced slides, and are actuated by indirect motion.

Annexed are a few leading particulars of the engine:

Gauge, 4 ft. 8½ ins.; cylinder, 20x26 ins.; valve, balanced.

Boiler—Type, straight; material, steel; diam. 66 ins; thickness of sheets, 11/16 ins: working pressure, 200 lbs.; fuel, soft coal; staying, radial.

Fire box—Material, steel; length, 96¼ ins.; width, 66 ins.; depth front, 63 ins; depth back, 51½ ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ½ in.; tube, ½ in.

Water Space—Front, 4 ins.; sides, 3 ins.; back, 3 ins.

Tubes—Material, steel; wire gauge, No. 11; number, 336; diam., 2 ins.; length, 14 ft. 5 ins.

Heating surface—Fire box, 151 sq ft.; tubes, 2,524 sq. ft.; firebrick tubes, 22 sq. ft.; total, 2,697 sq. ft.; grate area, 44.1 sq. ft.

Driving Wheels—Diam., outside, 68 ins.; inside, 62 ins.; journals, 8½x10½ ins.

Engine Truck Wheels—Front diam. 30⅞ ins. journals, 5x10 ins.

Wheel Base—Driving, 13 ft. 6 ins.; rigid, 13 ft. 6 ins.; total engine, 24 ft. 4 ins; total engine and tender, 51 ft. 10¼ ins.

Weight—On driv. wheels, 112,685 lbs.; truck, front, 35,950 lbs.; total engine, 148,635 lbs.; engine and tender about 259,000 lbs.

Tender—Wheels, No. 8; diam. 33 ins.; journals, 4¼x8 ins.; tank capacity, 5,500 gals. water; 7 tons coal; service, passenger.

Favors Baker Heater.

In his report on Lighting, Heating and Ventilation of Trains, submitted to the International Railway Congress, Professor Dudley, of the Pennsylvania Railroad, said that for car heating the best method is to use steam from the locomotive, and he particularly recommended the Baker heater system, which admits of the use of either steam or coal, as may be desired.

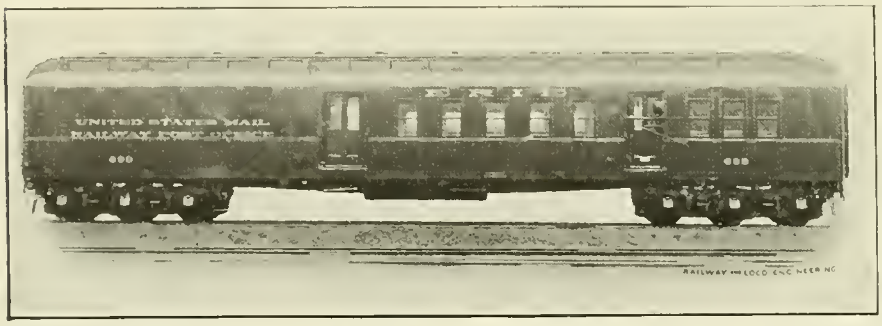
The Buda Foundry & Mfg. Co., of Chicago, have issued two catalogues on "Track Construction and Maintenance." One of these catalogues is printed in English, and the other is printed in French. The illustrations are the same in each, and show the patented pressed steel wheels, the Buda hand and push cars, Buda track velocipedes, and a great variety of ratchet ball-bearing and friction jacks, track drills, car and engine replacers, and switch stands. A list of the anti-friction metals and alloys made by the Buda Co. are also given. This excellent catalogue may be had by any one who will apply to the company for a copy.

The *Erie Railroad Employees' Magazine*, now in its fourth month, has been taken in hand by Mr. J. H. Maddy, famous for his push and newspaper enterprise. Mr. Maddy had occupied the editorial chair about two hours when he solicited an article from the editor of RAILWAY AND LOCOMOTIVE ENGINEERING.

Erie's Steel Postal Car.

At the International Railway Congress, held in Washington last month, the numerous visitors displayed much interest in the steel postal car shown in our illustration, which was on exhibition there. Railroad men who have examined the car very carefully, declare that it is the best. That, too, is the expressed opinion of the post office department officials, given after an inspection by Postmaster-General Cortelyou, Fourth Assistant Postmaster-General DeGraw, and those under whose direct supervision the post office car service comes.

The new car is the outcome of the ideas of President F. D. Underwood, of the Erie, built at his suggestion and in accordance with those ideas, by the Standard Steel Company, of Pittsburgh. Plans as prepared were submitted to the postal authorities at Washington and met with their entire approval, it seeming to meet all the demands in way of strength, convenience, and absolute fireproof qualities, while owing to the weight of the car (something over 100,000 lbs.) its riding qualities are as near perfection as it is possible to obtain in a car of this sort.



STEEL MAIL CAR FOR THE ERIE.

The car, whose inside length is 65 ft., is entirely of steel as to its exterior, and wherever wood has been used in inside fittings as in the mail racks, sorting tables, etc., fireproof wood with cast iron trimmings has been used. A door midway between the two ends of the car, practically divides it into two sections, one being for storage, while the other end is for the sorting tables and letter racks. The former is entirely closed, but the latter is well lighted by eight windows, and a subsidiary door on either side. For night work an elaborate Pintsch gas system is provided. The Gold steam car heating system is used, Westinghouse air brakes and signals are provided, and the car is equipped with Master Car Builders' couplers. It is mounted on Erie standard six-wheel trucks, and its perfection and finish, both as to exterior and interior, has excited the lively interest of the representatives of the foreign railways, who seem to find in it something so novel that they never tire of its inspection.

The doors of the car, both on the ends and sides, are made of fireproof wood instead of steel, in order to facilitate the escape of the mail clerks from the car in case of accident which would make it necessary for them to cut their way out of the car.

Recent addition to the rolling stock of the Erie also include a steel express and steel baggage car, made on practically the same lines as the postal car, with different interior arrangements to suit their various uses. These two cars are also novelties in railroad construction, and in the experimental trials in which they have been used, they seem to fully satisfy the ideas of Mr. Underwood, who is also the originator of this idea for carrying steel construction beyond the uses to which it has been put heretofore. The baggage and express cars are both 60 ft. inside measurement, with a total weight of 107,000 lbs. each, and these, too, are mounted on the standard six-wheel trucks, thoroughly equipped with air brakes, gas, signal and heating devices of the most approved type.

The Boston & Albany Railroad have recently issued a very artistic brochure entitled, "A Study in Railroad Gardening." The half-tones used illustrate how railroad grounds are transformed into beautiful parks. In one instance, tall flowering shrubs mark the border line of the station grounds. In looking at another, no one would guess that the railroad is only ten feet away from the scene which is exhibited. Natural ponds have been utilized, footpaths have been made, while lawn and trees have been combined in various pleasing effects, and in fact what may be called a railroad garden has been changed. The effect is even beautiful in winter, as is shown by the tailpiece on the last page. The whole is by Mr. Frank A. Arnold, and is a reprint of his article which appeared in *Suburban Life*. The Boston & Albany Railroad will be pleased to send a copy of this little work to any one who will apply to Mr. A. S. Hanson, G. P. A. of the company, at Boston, Mass.

Active Demand for Cars.

The demand for new cars is remarkably active, and shows that railroad companies have perfect confidence in the active business which now prevails keeping up for a year or two. A gentleman connected with a large car building works estimates that the orders for cars will aggregate at least 100,000. The types of cars demanded are varied, though they generally follow the lines that have characterized car building for the past four or five years. The bulk of the freight cars ordered will be of from 60,000 to 80,000 lbs. capacity, and a large percentage of the aggregate will be of the 100,000 lbs. variety. Different capacities predominate in different kinds of cars, and while the ore and coal cars are mostly of 40 to 50 tons capacity, the box cars and flat cars will carry 30 and even as low as 20 tons.

In this connection, the recent report of one of the master car builders' committees on the development of freight cars gives some interesting data. In comparing the cars built 30 years ago with those turned out now, it is observed that in 1871, 10 tons was the usual capacity of a freight car, and six years later 15-ton coal and box cars were considered experiments. In 1880 the majority of freight cars built were designed to carry 15 tons, and a few were of 20 tons capacity. Nine years later the average capacity was 30 tons, and in 1896 40-ton cars were in common use. In 1899 the employment of 50-ton cars became general; this is now the maximum for general use, although cars of larger capacity have been built for special purposes. With the increase in capacity, other vital changes have been made in car building, the most important of these being the introduction of steel as material.

An executive committee meeting of the Panama Canal Commission was held lately to consider contracts for the complete re-equipment of the Panama railroad. Representatives of locomotive works and car builders are being consulted by the committee to this end. It was decided at the recent meeting of the directors of the road in New York that if the road is to serve the double purpose of taking care of the commercial traffic across the isthmus and also become the important factor required in the construction of the canal, the heaviest and most modern equipment obtainable must be secured without delay.

Secretary Murphy of the commission has been instructed to leave Washington for the isthmus with a part of the office force of the commission here on May 13. Mr. Murphy will open permanent headquarters there for the purpose of conducting the major portion of the clerical work necessary at close range.

The New King-Lawson Dump Car.

One of the most interesting exhibitions at Washington was the King-Lawson 80,000-pound steel pneumatic dump car. This car is designed to dump a load of 40 tons on either side of the track, the doors then closed, and the car ready to be again loaded in less than 30 seconds. This car is operated by air pressure taken from the air brake system, the air for operating the dump being stored in a reservoir fitted with check valves which prevent the reduction of train line pressure while the car is dumping its load. The King-Lawson car at work on the D., L. & W. R. R. at Kingsland in rock excavations has been loaded and dumped seven times in 55 minutes, taking the material some 1,500 or 2,000 feet. This same car was loaded and dumped 355 times during the month of April with the same material, a little oiling being the only expense involved. The car is handled by the train men, and requires no special knowledge to perform the operation, simply opening the air valve to dump the car, and then closing the valve to replace the doors and adjust the car for its second load.

Swiss and American Engine House Design.

A very good example of how similar designs, or even inventions, may be worked out independently by persons widely separated as far as geographical location is concerned and who could have no knowledge of, or communication with, each other, recently came to our knowledge.

In June, 1904, on page 285, RAILWAY AND LOCOMOTIVE ENGINEERING published an abstract of a paper on Square Roundhouses, read by Mr. Geo. P. Nichols before the Western Railway Club, and in order to further illustrate the subject we gave a view of a Swiss running shed and yard, in which the doors of the engine house were arranged in an indented wall, which in plan looks very like a series of steps on a stairway.

Mr. J. J. Turner, third vice-president of the Pennsylvania Lines, some time ago designed what has been called the Echelon engine house, which is somewhat similar to the Swiss design, though neither Mr. Turner nor the Swiss engineer had any knowledge of the work of the other, the object in each case being to get away from the conventional circular roundhouse, with its central turntable.

Echelon is a French word, and its meaning can perhaps be best explained by the use of a familiar illustration. Suppose a company of soldiers to be drawn up in line all facing due north. If the order to advance were given the entire company would move north, as a ruler might be rolled forward on the table. If, however, the order "face half left" were obeyed, each individual man would turn, as nearly as may be, toward the northwest point of the compass. The order to advance would then send the line forward, parallel to itself, without wheeling, and in a northwest direction. The men would now be advancing *en echelon*.

The plan of the Swiss running shed has all the doors on what might be called the risers of a set of steps. The Echelon engine house has all the doors also on the risers, but each riser slopes, so as to make an obtuse angle with the tread in each case. The outline of the Swiss plan is, as we have said, like a stairway with risers and treads at right angles to each other. The Echelon plan somewhat resembles the teeth of a carpenter's crosscut saw.

The advantage common to both these plans which the circular house does not possess is that each is capable of indefinite extension, while the turntable, being conveniently placed, is adequate no matter how many stalls may be built. The details of the Echelon shed have been worked out by Mr. R. Trimble, chief engineer of maintenance of way of the Pennsylvania Lines.

The Echelon engine house is layed out between what may be called two ladder tracks, parallel to each other, one on each side of the house. From these tracks spurs run into the building, and two of them pass right through and are each under an overhead crane. The coaling and ash pit tracks are at one end of the house and the turntable is placed near them.

The Echelon engine house takes up more room than the circular form, but the room so taken is put at the disposal of the roundhouse staff, and the window area is greater than in the usual form. Sufficient room and plenty of daylight are two requisites which mechanical department men have too often been deprived of in running shed construction. An Echelon engine house has not yet been built, but the Swiss shop is actually in use.

"There is no place like home," as the devil remarked when the drummer introduced him to the Stock Exchange in full blast.

Locomotive Topics at International Railway Congress.

The International Railway Congress, which met in Washington, D. C., last month, was a highly important event and brought a great many eminent visitors from foreign countries, and it gave the members of the American Railway Association an opportunity to display princely hospitality to their visitors.

The plan of carrying on the meetings of the congress was to have a separate hall for each of the five sections, and only the subject pertaining to that part were introduced. The official language was French, and all discussions in English were translated by an official interpreter into French, and the discussions and papers were all translated back into English, which made rather tedious proceedings.

Very few German railway officials were present. They were offended because French was the official language, and displayed their resentment by staying away and losing the best opportunity for enjoying a glorious good time that will ever come to the organization.

President Fish opened the general proceedings with a most interesting address, in which he outlined the development of American railroads, explaining many of the physical conditions likely to strike visitors as being odd, not to say crude. He reminded the meeting that when railroad construction was begun here, about 1830, the whole region west of the Alleghany Mountains was uninhabited. The spectacle now so common of railroad tracks passing through towns at grade was due to the town springing up after the railroads were built. Figures were presented, showing the public performance of American railroads and the rapid increase of service. The address formed a good explanation of the conditions under which American railroads developed and the influences affecting their operation to-day.

ENGINES OF GREAT POWER.

The proceedings that our readers are likely to be most interested in are those of Section 2, which embraced all motive power considerations. The work was begun by the reading of a paper on Locomotives of High Power by Mr. J. E. Muhlfeld, of the Baltimore & Ohio, which was rather an extraordinary production, and will receive detailed attention from us later. The salient point made by Mr. Muhlfeld was that the progress in increasing the size of our locomotives has been too rapid and lacked careful consideration. He criticized the designs of several locomotives that are in service, showing that he was not afraid to make his opinions public.

We have been surprised to find that so little dissent was expressed from Mr. Muhlfeld's opinions. We are inclined to think that the paper would have raised a lively discussion had it been read before the Master Mechanics' Convention.

Mr. E. Sauvage, Western Railway of France, read the conclusions of a report he had previously submitted on Powerful Locomotives. He favored restricting the wheel loads to 10 tons, and thought it was desirable to have the tracks made to stand that load. He seemed to think that the standard track gauge is sufficiently wide for the wheel loads that rails can endure, and mentioned that in countries where wide gauge is employed the locomotives are not heavier than those used on standard gauge lines. The belief was expressed that two meters (6 ft. 6¾ ins.) was a safe limit for the diameter of driving wheels. An objection raised to larger sizes was the great weight carried below the springs.

Mr. Sauvage discussed grate area in connection with boilers for powerful locomotives, and said that great objections had formerly been raised to placing the grates above an axle, but foreign engineers are coming to adopt that form with the Atlantic type of engines. Serve tubes, he said, are generally used in France, and they increase the heating surface without enlarging the boiler. He was favorable to compound locomotives, but preferred the four-cylinder balanced type. He said that no valve motion had succeeded in displacing the slide valve and link motion.

Comments were made on the two papers by about twenty members, the remarks turning principally upon the merits of compound locomotives. The consensus of opinion was that compounding saved about ten per cent. of fuel. The French members all insisted that the cost of repairs was not greater on a compound than on a simple locomotive.

Mr. William Forsyth, of the *Railway Age*, introduced remarks on the Maintenance of Boilers, which excited considerable discussion.

Mr. A. W. Gibbs stated that the wear of fire boxes is not so rapid as it is commonly believed to be. In a boiler having a life of 20 years on the Pennsylvania Railroad the fire box on an average has to be replaced only twice.

Mr. D. F. Crawford, Pennsylvania Lines, made some remarks favorable to piston valves. He said that the wear was less than that of flat valves, and the engines were easier handled.

Mr. Muhlfeld summed up the discussion. He believed that the principal differences between American and European practice is that our boiler pressure is higher; and in relation to compounds, we aim for greater tractive force, while in Europe the principal requirement is economy of fuel.

A draft of conclusions on the question of Engines of Great Power was read by the president, which we will publish in a future number.

POOLING OF LOCOMOTIVES.

This subject was introduced by Mr. Boell, State Railways of France, with the following conclusions of papers prepared on the subject:

1. That the pooling system always leads to a very perceptible increas in the expense per kilometer, and, therefore, it ought not to be employed except in case of absolute necessity.

2. That for the purpose of increasing the work of engines it is preferable to have recourse to the system of auxiliary crews, or to the multiple crew system, the evils of which are infinitely less.

3. That the double crew system is to be approved, particularly for switching, suburban or shuttle train service and even for certain classes of through train service, for the reason that, while affording better utilization of engines than the single crew system, it may permit of a slight saving in fuel without appreciable increase in cost of repairs.

4. That with these various systems it may be of advantage in fuel expense to assign to each engineman a particular tender which, however, gives rise to certain complications in the service and cannot always be realized.

5. That the system of three men crews may in certain cases be substituted advantageously for that of double crews.

6. Finally, that other systems than that of the single crew have little to commend them for fast express train service, which demands engines in a perfect condition of repair and well understood by the engineman who handles them.

The abstract of report prepared by M. E. Hubert, deceased, of Belgium, reported that of 50 railroads replying to questions on pooling of locomotives, 16 use single crews only, except in switching, where some use double crews, and that 24 roads, representing about 45 per cent. of the total mileage, prefer single crews. The report was not favorable to pooling, and it intimated that it increased the cost of operating.

A summary of a report made by Mr. G. W. Rhodes (Burlington & Missouri River Railroad), said:

1. The complete pooling system increases the cost of transportation.

2. The main advantage of the complete pooling system, which is of a nature to compensate for the increase in expenses, is the possibility of doing the work with fewer locomotives which ef-

fects a reduction of the capital investment.

Mr. Rhodes reaches the conclusion that the essentials for a properly conducted engine pool are as follows:

1. An engine house inspector, or inspectors, whose duty it is to report all work on incoming engines which shall be checked up with the engineman's incoming report. Provision should be made to have all work properly attended to; neglect in this matter has done more to injure and discredit pooling than any other feature. Men in a pool, when they report, work, and 10 days later get on the same engine and find the same thing which requires repair still not attended to, drop into careless habits. If a regular man had the engine he would raise objections until the work as reported was done. In a pool the foreman or workman has a chance to say: "Another man will get this engine who will not know whether this work was reported or not."

2. A sufficient engine house force to attend all cleaning of engines both below and above the footboard and in the cab. Provision to be made also for cleaning and filling all engine lights.

3. All lanterns to be maintained and kept under a tool room check system. Under this system lanterns are pooled in the same way that engines are, and each incoming engine crew has to account for its lanterns. The number of lanterns under this system is materially minimized through a large proportion being in constant service.

4. Heavy engine tools to be kept in a sealed box on the engine, the seal to be carefully inspected on each arrival. Eachengineman to be supplied with a portable tool box.

5. A kit of oil cans should be assigned to each engineer and returned by him after each trip and placed in the oil room, to be properly filled, cleaned and cared for.

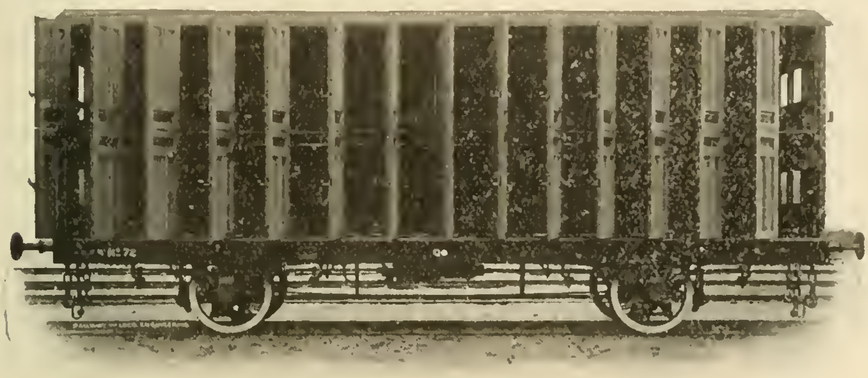
6. A set of enginemen's lockers or boxes should be at the disposal of the engine crew.

The report concluded with the statement that no hard and fast rule can be made that will fit all railroads in the matter of pooling engines. The conditions of traffic, together with the quality of equipment on each ro d alone can determine the expediency for or against pooling.

A long discussion followed the introduction of this subject which was participated in by members belonging to nearly all countries where railroads are used. The general impression given was that pooling of locomotives is not popular, and is of questionable utility.

Bicycle Van on the G. N. S. R.

The type of van shown in our illustration has been in use on the Great North of Scotland Railway for the past three years. The body has two stories, and each story is divided into fourteen compartments or stalls, thus making accommodation for twenty-eight bicycles. Each bicycle is carried in a separate stall, being led into position by guides screwed to the floor of each stall. At a convenient height above each set of floor boards is a padded board made 12 ins. deep to allow for variation in the height of handle bars. This board is 1 in. thick and is padded with wood shavings to a depth of 1 in. on either side, and covered with canvas, thus ensuring the cycles riding with perfect safety.



BICYCLE VAN ON THE GREAT NORTH OF SCOTLAND RAILWAY.

A door is fitted on either side of each compartment or stall, and attached to the door framing is a hinged slate panel carried in a separate frame by raising which one can see into the compartment without opening the stall door. These slate panels are placed in a convenient position so that the destination of the bicycle can be written on the one covering the cycle. Each door is fitted with a Maxwell's lock, and in addition a private Budget lock.

The underframe is made of oak, and has been designed so as to come as low as possible to allow greater headroom for the bicycles. The vehicle is fitted with the Westinghouse Quick-Acting Brake. The length of the body measured outside is 28 ft. 6¾ ins., while the width outside is 7 ft. 0½ in. The height from rail to roof is 12 ft. 8 ins. The total wheel base is 16 ft., and 37½ in. wheels are used, with 4x8 in. journals. The cycle van is a very convenient kind of car on the Great North of Scotland, as hundreds of tourists take their "wheels" north during the summer months. The springs of the van are light, as the maximum load adds little to the weight on the wheels. The object in building such a vehicle is to secure not only a compact but an absolutely safe method of bicycle transportation. The danger to which bicycles are exposed is not so much that of damage as it is of theft.

Train Test of New Westinghouse Devices.

Some practical train tests of vast importance to the railroad world were made for the benefit of the visiting International Railway Delegates by Mr. Geo. Westinghouse, at East Pittsburgh and Wilmerding a few days ago to demonstrate by actual service trials how accidents involving loss of life and destruction of property can be avoided. The special train on which the tests were made consisted of fifty modern steel cars, fitted with automatic couplers having a friction device incorporated in the draft gear of each car capable of absorbing an immense amount of momentum energy which would otherwise be very destructive to the car frames. This destructive energy also contributes largely to breaking-in-two of trains, and is frequently placed upon burst air hose, broken knuckles, couplers, etc.

The couplers of the fifty cars were also fitted with a device which automatically couples the air brake pipes at the same time that the couplings themselves are united, while the handles of the stop cocks of the air brake pipe are arranged that they can be operated from either side of the train, in order that employees need no longer be required to go between the cars for the operation of either the car couplings or air brake couplings.

The triple valves used upon the cars of this train were of the improved type, and by their use the brakes upon the last car of the longest train are set almost as quickly for ordinary service stops as in the case of an emergency application. The improvements in these triple valves, Mr. Westinghouse asserted, were as important with reference to the air brake art of to-day as were the earlier improvements whereby the brakes were made to act automatically in the event of the breaking-in-two of a train or the bursting of a hose pipe. The very commendable feature, and one characteristic of all of Mr. Westinghouse's inventions, is that by which the loss of the present standard triple valve is not involved in changing to the new, since the present standard Westinghouse triple valve may be altered to embrace all the improved features of the new form.

In the tests made by Mr. Westinghouse for the European delegates it was shown that it was impossible for the engineer, with the heaviest locomotive, by any effort he could make, to break the train in two. A test was made by first bunching the slack of the fifty cars and then starting the locomotive by using a heavy throttle. This failed to break the train in two. The next test was made by applying five rear hand brakes, and with the slack bunched, a rough start was made with the heavy throttle. This test failed to break the train in two. The next test was by making a rough start by using a heavy throttle, and when the train attained a speed of twenty miles per hour with the engine using steam, the rear angle cock on the train was opened and an emergency application of the brake obtained. The engine continued to use steam until she was brought to a standstill by the brakes. The train did not break in two. A severe test was made of backing up the train at a speed of eight miles per hour when the reverse lever was thrown ahead and steam used. This action failed to break the train in two. A collision test was made by cutting off that portion of the train back of the fifteenth car, and backing the head portion of thirty-five cars and locomotive into it at a speed of eight miles per hour. This test failed to break any knuckles, couplings, or draft gear, the momentum energy being arrested and absorbed by the friction draft gear.

"With any train, whatever its length, fitted with friction draft gear," said Mr. Westinghouse, "it will be impossible for an accident to happen from the bursting of a hose in the middle of the train, even if the rear cars are not fitted with air brakes. The friction device referred to has been adopted by the Pennsylvania R. R. and is being applied to all of its new cars and to the cars of many other roads, and already 120,000 cars have been thus fitted."

Another very interesting feature of the exhibition was the single-phase alternating locomotive, exhibited for the first time. "This locomotive is capable of exerting a draw bar pull of 65,000 pounds," said Mr. Westinghouse, "and could have hauled 100 cars as easily as the heavy steam locomotive moved the fifty cars." The electric locomotive was operated by the current from an overhead wire no larger than that required for an ordinary street car. The electric pressure, however, was ten times as great as that used for street car work. The locomotive in question has been designed to assist heavy freight trains up steep gradients on an important railroad.

"The act of Congress in relation to the use of automatic couplings and air brakes on locomotives and cars engaged in interstate commerce," continued Mr. Westinghouse, "was passed at a time when there had been little or no experience in the operation of brakes on long trains and when trains of over fifty cars were unusual. The advent of heavy locomotives and of steel cars has made, however, a great increase in the weight and length of trains and has made a reconsideration of the whole subject necessary, if not imperative."

This practical test made for the visiting International Railway Delegates speaks more convincingly of the real value of the devices in question than could any array of figures coming from the laboratory. A device is always better tested in actual service, where conditions are exact than in a laboratory where only a close approximation of actual existing conditions may be assumed, and such test will be accepted as more conclusive than any amount of theorizing or even abstract analytic reasoning. Mr. Westinghouse has shown by practical train test, in the same manner that he did with the automatic air brake some years ago, that great mechanical achievement can only be realized by resolving the idea to actual service practice.

A neat little pamphlet which is concerned with explaining the operation of a new double friction coil clutch has recently come to the office. It is by the Double Friction Clutch Company, of Chicago. The device consists, briefly, of a chilled drum which is keyed to the shaft. Around this drum is a spiral coil mounted on the hub of the clutch. The first action of the clutch is to put friction on the ends and then gradually bring the friction between coil and chilled drum into play. Hence the name double friction clutch. It is claimed that this clutch will do the work required on a slow speed shaft, and can be adjusted to slip at any desired horse power. Oil is freely used. In fact, the case is filled three parts full of oil, in order to reduce the wear on coil and drum. If you are at all interested in friction clutches, it would be well to write to this company for this folder and any other information you may wish concerning the construction or action of the double friction coil clutch.

We have lately come across a specimen of a hose coupling which was sent to the office, which for "neatness and dispatch" surpasses anything we have seen in this line. The coupling is made in two pieces which fit together very accurately. The pipe itself projects through the coupling so that when connection has been made the bore of the tube is unaltered. A rubber gasket is what makes the coupling air-tight, as it is an air hose coupling made by the Cleveland Pneumatic Tool Co. The couplings are made dovetail with two projections on each, and it is only necessary to press the couplings together. The pressure thus applied pushes back a sleeve which is held in position by a concealed coil spring. The projections in sliding past one another press the pipe end and rubber gasket together, and when moved through one-quarter of a turn the dovetail couplings snap sharply into position, and a tight joint with uniform pipe bore is the result. The coupling is fully illustrated in a folder which has recently been issued by the Cleveland Pneumatic Tool Co. This company will be happy to send the folder to any one who is interested enough to apply to them for a copy.

Locomotive Hand Car.

A very useful hand car has lately made its appearance, which is fitted up for the accommodation of men and tools. This can be accomplished all the more easily by reason of the fact that the handles usually employed for "pumping" are entirely absent, the car is equipped with a single cylinder engine of the automobile type, which has plenty of power to drive the car loaded with men and tools over any ordinary railroad. The maximum speed of this car is 15 miles per hour. It could, however, be run faster if necessary. This car has advantages over the ordinary hand car for section work which the practical man will appreciate.

The platform is somewhat longer than the ordinary hand car and is large enough to accommodate eight or ten men with a full set of tools for that number. The car is made by Fairbanks, Morse & Co., and is light and strong, and the fact of its being in reality a motor car insures the reduction of time necessary to transport men and light material over the road. For inspection purposes this car is a very useful addition to the track supervisor's outfit.

Some have thought that with the introduction of motor hand cars that it would be possible to make the sections longer, as the time of going and coming of each gang would be greatly reduced. Extra service crew, such as rail gangs, bridge, wrecking, and ditching gangs, could be economically handled by the aid of this little motor car, and altogether more accurate "crossings," if we may so say, might be made by these motor cars with trains, when they have the wider range of speed which the locomotive hand car would certainly give them.

Signal Protection on Queen & Crescent System.

We have several times published descriptions of the signaling system in use on the Queen & Crescent Route, and it is with much pleasure we have just read an exhaustive illustrated description of the system in the *Railway Age* of April 28. We heartily endorse the following paragraph, which concludes the article:

"It is not an exaggeration to say that for safety of method, combined with simplicity of operation, the 336 miles from Cincinnati to Chattanooga is not equaled or even approached on any other railway in the United States, and probably not in the world. It is an object lesson for those who wish to know, as well as for those who ought to know, what can and should be accomplished upon the railways of the United States toward securing the safety of their trains."

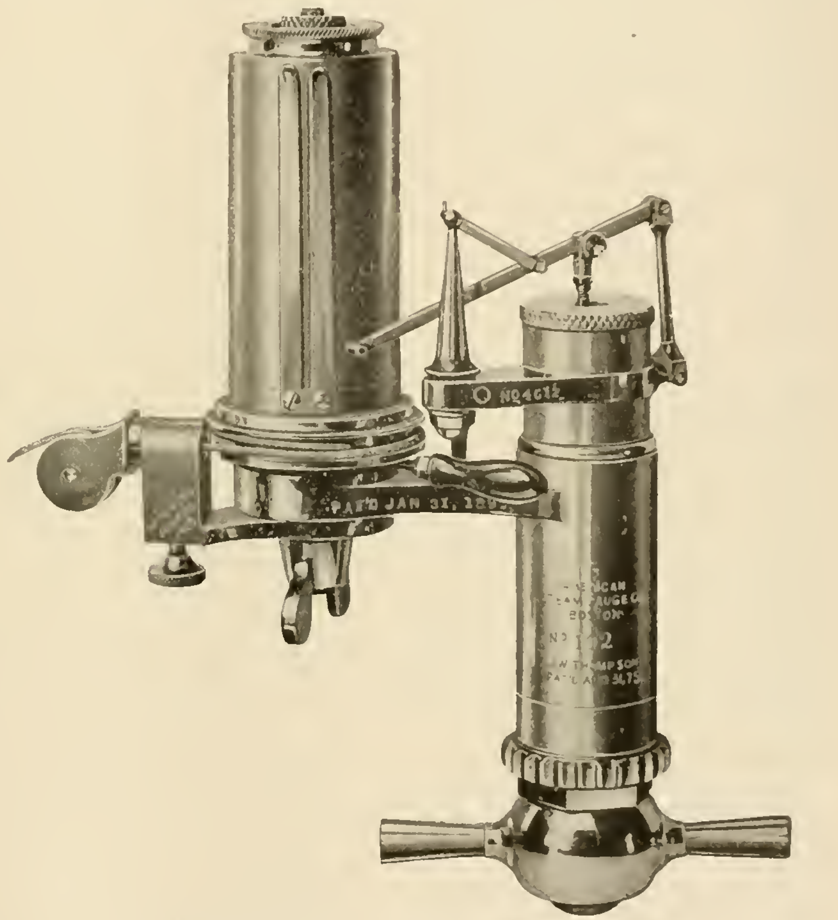
The Litchfield Foundry & Machine Co., Litchfield, Ill., has made a contract to build stationary engines equipped with the Haberkorn valve gear. This gear has been applied to some locomotives and works well.

Handsome Car Coupler Catalogue.

As a work of art we have rarely seen a more beautiful catalogue than that which has just come from the press, and which is called "The Evolution of Car Couplers." It is issued by the McConway & Torley Co., of Pittsburgh, Pa., and the explanations are printed in English and French. The illustrations begin with the old link and pin coupler and show the man between the cars. The next illustration shows the original Janney coupler as patented in 1873. Next follows the illustration of the 1874 patent, the 1879 patent and the 1882. The Kelso coupler also comes in for illustration, and is shown in both perspective and in line cuts. The new Pit coupler is drawn in perspective and in three sectional views which show the knuckle closed and locked, also the locking pin; in unlocked position sustained by the lock set; and lastly the knuckle opener pushing the knuckle open. The old Miller draw hook and platform are shown, and following that is the modern "Buhoup" three-stem coupler. Illustrations of the M. C. B. gauge for new couplers, and the Purdue testing machine are also given. The jam coupler contour lines are shown in more than one illustration. The "Buhoup" is fully illustrated, and there follows with the explanation several interesting cuts of foundry work, early and modern passenger trains, the latter from the pages of RAILWAY AND LOCOMOTIVE ENGINEERING, and several varieties of railway cars equipped with the McConway & Torley Co.'s specialties. This company will be happy to furnish a copy of this most artistic catalogue to any one who is interested enough in car couplers to apply to them for one. This catalogue is the work of Mr. Stephen C. Mason, secretary of the McConway & Torley Co., and it is a work of which both printer and author may be justly proud.

New Improved Detent Motion.

The greatest improvement added to the steam engine indicator since the advent of this instrument of precision into the engineering field, is the New Improved Detent Motion, which the American Steam Gauge & Valve Mfg. Co., Boston, Mass., have added to their well-known American Thompson Improved Indicator. This attachment makes the indicator particularly applicable to high speed stationary and marine steam engines, locomotive and gas engines. With this attachment it is possible to connect the indicator to high speed, reducing motions and stop the drum of the indicator without unhooking the cord or stopping the engine. The stopping and starting the drum carriage of the ordinary indicator, whenever it becomes necessary to change cards is usually attended by many vexatious happenings; this is entirely avoided by this new attachment. Cards may be taken in rapid succession; this being particularly desirable on tests where the load is variable and on locomotive tests where it is particularly desirable to take cards in rapid succession; in making a test of this kind, it is important, during certain periods of the test, to get as many cards as possible. With an ordinary indicator not equipped with this New Improved Detent Motion and where an indicator is



NEW DETENT MOTION FOR STEAM ENGINE INDICATOR MADE BY THE AMERICAN STEAM GAUGE & VALVE CO.

equipped with an old style paul and ratchet detent, it is not possible to take as many cards as should be taken in order to get accurate results of the tests. The locomotive indicator is fitted with a 1½-in. paper drum and is particularly adapted for high speeds and the severe conditions to which it is subjected.

The detent motion is contained within the paper drum, and is operated by means of a lever below the drum carriage. To stop the paper drum, this lever is moved in the direction traveled by the paper drum. When released, it is returned by means of the auxiliary spring to a position ⅛ of an inch beyond the end of the stroke, making it impossible for the drum to engage until desired.

The drum carriage having the full tension of the main drum spring continues to rotate in the usual manner, preventing any whipping or sagging of the cord. This allows the indicator to be used with the detent motion in connection with a reducing wheel connected directly to the indicator.

The drum is supported on the spindle by means of a collar held stationary by a pin engaging the slot in the spindle, on which rotates an outer sleeve, which acts as a bearing and guide for the drum. To the stationary collar is fastened the inner end of the auxiliary spring, the outer end being fastened to the auxiliary spring case, which is held stationary in the paper drum. The tension of this spring is such as to cause the drum to return to its position before the return stroke of the drum carriage.

When in action the drum is controlled by a pin engaging a hole in the grooved wing at the bottom of the drum. By turning the lever, this pin is lowered on the return stroke of the drum carriage, releasing the drum, which is returned beyond the end of the stroke by the auxiliary spring. The lever is then returned to its original position, allowing the pin to elevate again. When the card is changed and ready to take another diagram, the drum is turned forward by means of the milled rim on top. This causes the pin to engage the hole, being guided by an incline, causing the drum to rotate in the usual manner, the motion being smooth and without shock, there being no chance to break the cord as with the old style paul and ratchet detent motion.

The parallel motion used in connection with this make of indicator is the well-known original Thompson parallel motion; the ratio of the lever being three to one, makes a very stiff and rigid motion, making it impossible for the slightest error to escape being shown in the diagram. The piston and other working parts of the instrument are made as light as is practical to make them. The piston head and steam cylinder are made of special mixture of composition which gives an equal expansion under the varying thickness of metal; this is particularly desirable in reducing friction at this point.

The accompanying cut illustrates their make of indicator fitted with the Detent Motion. The great advantage of this attachment will be readily appreciated by the users of the indicator, and it has added considerable merit to the already popular instrument.

Exhibits at Washington.

The Convention of the Seventh International Railway Congress, held at Washington last month, was the means of bringing out what was probably the finest exhibition of railway appliances ever seen in this country. The exhibits were located in Monument Park, a part of the White Lot, and in order to have them there special permission had to be obtained through Congress. When it is considered that all of the buildings were erected and appliances installed, representing an outlay of more than a million dollars, in the short space of forty-three days, great credit is due to Chairman George A. Post, Mr. J. Alexander Brown, director of exhibits, and the rest of the committee of the association.

The following is a partial list of the exhibitors, and they will be pleased to furnish catalogues for the asking:

The Pittsburgh Spring and Steel Company was represented by Mr. D. C. Noble, the president of the company. Their exhibit comprised probably the most complete line of railway springs ever exhibited. The unusual size and great capacity of some of these excited considerable surprise.

The Duff Manufacturing Company, of Pittsburgh, had a full line of jacks. The Duff roller bearing screw jacks, with a lifting capacity up to 70 tons, being on exhibition for the first time.

The Lodge & Shipley Machine Tool Company had an electrically driven 24 ins. patent head standard engine lathe. Railroad shops would find this to be a very useful and high-class tool.

Jenkins Bros.', John street, New York, exhibit of the numerous kinds of valves which they manufacture was exceedingly attractive. They distributed a book entitled "Valve Troubles, and How to Avoid Them." Anyone interested can obtain one for the asking.

As usual, the Chicago Pneumatic Tool Company was one of the largest exhibitors, and attracted a great deal of attention.

Underwood & Co., of Philadelphia, had a line of portable tools for boring cylinders, facing locomotive valve seats and turning crank-pins. They also exhibited a two horse power two-cylinder air or steam engine to be used in connection with their portable tools.

The Victor Stoker Company's automatic locomotive stoker, which was in operation, aroused considerable interest. The automatic stokers are being seriously considered by many railroad officials, and it is only a question of time before they will be universally adopted.

L. J. Bordo Company, of Philadelphia, had on exhibition their high-grade blow-off cocks and flexible joints. Mr. Bordo says that they have been made standard on a large number of railroads.

Flannery Bolt Company exhibited a good display of their flexible stay bolt, which boiler users are regarding as a means of putting an end to the danger of broken fire box stay bolts.

W. H. Johns-Manville Company, of New York, displayed asbestos and magnesia lagging for locomotives, train pipe and boiler covering, fireproof lumber, Vulcabeston, smoke jacks, Kearsarge and asbestos packing, refrigerators, insulators, etc.

The McConway & Torley Company, Pittsburgh, Pa., display of couplers was most complete. An electrically driven model of the "Pitt Coupler" practically demonstrated the operation of the coupler's every movement. The company has just published one of the most artistic catalogues it has been our pleasure to see. It will be sent on application.

Acme White Lead and Color Works, Detroit, Mich., had a very attractive exhibit of their paints, varnishes, enamels and stains, also of Pandect, a preservative for steel cars and structural work. They were represented by Benson E. Brown, Robert C. McIntosh and H. L. Wilson, who were very much in demand on account of the useful souvenirs of a pocketbook and the carnations which they were distributing.

The combined exhibit of the Railway Materials Company, the Ajax Manufacturing Company and the Draper Company was one that received a great deal of attention. The Railway Materials Company had in operation one of their Ferguson furnaces, which turned out work so rapidly that it kept in constant operation the Draper flue welder and a large riveting machine of the Ajax Manufacturing Company.

The Buda Foundry and Manufacturing Company's, Chicago, Ill., exhibit consisted of a great variety of track tools and equipment. They are the largest manufacturers in their line. A very handsome and complete catalogue, which they have just published, will be sent for the asking.

American Brake Shoe and Foundry Company had a large display of steel back brake shoes and steel castings. Also a collection of pictures showing the growth of the brake shoe up to the present time.

American Steam Gauge and Valve Manufacturing Company.—One of the prettiest arranged exhibits on the grounds displayed muffled and open locomotive pop safety valves, steam and air brake gauges, also the American-Thompson improved locomotive indicator.

The American Valve and Meter Company were determined to make their exhibit attractive; held hourly stereopticon shows, consisting of pictures of what they are manufacturing. It was a first-class "object lesson," and Mr. N. Paul Fenner, Jr., deserves a whole lot of credit for the innovation.

J. S. Andrews & Co., New York.—Andrews' solid cast steel truck frame.

Armstrong Bros.' Tool Company, Chicago, "The Tool Holder People," exhibited a number of very useful labor-saving devices, which could be used to advantage in every railroad shop. They will be pleased to furnish a full catalogue for the asking.

Cling Surface Company, Buffalo, exhibited a model of a belt dressed with their compound in operation. There is no doubt that it increases belt capacity to a very large extent.

Consolidated Railway Electric Lighting and Equipment Company, the "Axle Light" System, had in operation a truck showing the working of their device.

Crane Company, Chicago.—A large display of hydraulic valves, blow-off valves, locomotive safety valves, high pressure steam valves, etc.

John Davis Company, Chicago, had a small but very attractive exhibition of steam specialties, couplings and steam joints.

Detroit Seamless Steel Tubes Company, of Detroit, exhibited samples of cold drawn seamless steel tubes. This was a very attractive exhibit, as they had samples showing the process of manufacture from the billet to the completed tube.

Falls Hollow Staybolt Company displayed bars of hollow staybolt iron of different sizes, bars that were bent without being fractured; also broken bars showing fibrous fracture. They claim that they are meeting with great success from the railroad companies.

Gould Coupler Company.—Electric car lighting system, foreign car coupler, Gould Z-beam steel platforms for passenger cars, friction buffer draft gear, freight car steel couplers, car steel bolsters and friction draft gear, journal boxes, spring buffers and tender couplers.

Homestead Valve Manufacturing Company had an excellent display of their make of valves which ought to be better known to railroad men. They comprise locomotive blow-off valves, straightway valves, three-way valves and four-way valves. They have balanced plug and internal locking devices.

Kennicott Water Softener Company had a beautifully constructed booth decorated with photographs of water softening plants which they had installed. Some of them were located on the Chicago, Burlington & Quincy, Pittsburgh & Lake Erie, Pennsylvania, and Union Pacific.

McCord & Co.—Journal boxes, Gibraltar bumping post, draft gears, spring dampeners and McCanna force feed lubricators. Also McKim gaskets.

Manning, Maxwell & Moore had a very large and prominent display of machine tools and railway devices.

National Malleable Castings Company exhibited malleable iron castings, Tower and Climax car couplers, pneumatically operated National radial draft gear, National journal box, with equalizing wedge or key, National brake jaw, National brake lever.

Niles-Bement-Pond Company had the finest display of large machine tools. Among them was a 96-in. hydraulic wheel press, a 37-in. boring and turning mill, a 42-in. engine lathe and an 1,100-pound steam hammer.

T. H. Symington Company had a very fine display of journal boxes, center and side ball bearing; also dust guards.

Vacuum Cleaning Company seemed to get more than their share of patronage. The visitors seemed immensely interested in the way they cleaned car seats, carpets, overcoats, and, in fact, anything that came along. That this system of cleaning is a perfect success can be easily proven by examining the cars of the Central Railroad of New Jersey, who are using it.

R. D. Wood & Co., Philadelphia, had a most striking exhibit in a 150-ton hydraulic riveting machine with 18 ft. 6 in. gap.

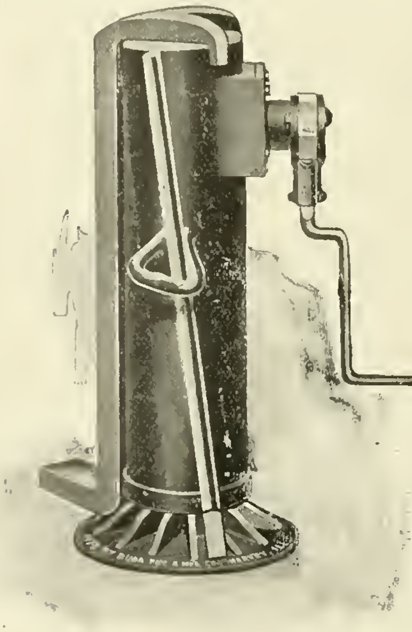
Norton Emery Wheel Company, Worcester, Mass., exhibited one of their splendid grinding machines, and showed some specimens of work done on piston rods and other parts where accuracy of finish is important. If railroad companies would finish their piston rods on these machines there would be much less trouble from glands blowing.

The Standard Paint Company displayed a model of a Pennsylvania Railroad roundhouse with the view of directing attention to the merits of their ruberoid roofing. It was very effective, and many of the visitors displayed much interest in the non-corrosive properties of the material.

The merchant engineering business, heretofore conducted under the firm name of William T. Bonner & Company, will hereafter be carried on under the name of the Wm. T. Bonner Company, under a charter of incorporation granted to the newly formed company. The officers are as follows: Wm. T. Bonner, President and Engineer; Lewis H. Homer, Treasurer and Secretary; P. A. Ferguson, Superintendent; John R. Marvin, Assistant Engineer. The directors, in addition to Mr. Bonner and Mr. Homer, are: Mr. A. E. Cox, who is treasurer and general manager of the Atlantic Works, East Boston, Mass.; Mr. Harvey S. Chase, engineer and expert accountant, and Mr. William S. Hatch, attorney at law. The New York sales office of the company is at 141 Broadway.

The Buda Ball Bearing Locomotive Jack.

Among the recent new things which the Buda Foundry and Manufacturing Company have added to their list of railroad appliances is their style 110 Ball Bearing Locomotive Jack, an illustration of which is shown herewith. It will be seen that the internal working parts are thoroughly protected from dirt of any kind and from the weather. This is an essential feature for this class of jack, as it is of importance that it be in working order when needed. In height it is 24 inches, has 11 inch rise; diameter



THE BUDA BALL BEARING LOCOMOTIVE JACK.

at base 13 inches, capacity 25 tons, weight 149 pounds. A hook for low set loads is provided, making it thoroughly serviceable for locomotive work. The component parts are of the best material and the workmanship careful to a degree that the makers give it their full guarantee.

The Rale Railroad.

"Misther O'Tunder," said Mr. O'Toole, "can ye tell me wan thing?"

"Oi kin tell ye more nor thot," asserted Mr. O'Tunder.

"Thin tell me this: Is a railroad a rale road?"

"It is not, Misther O'Toole. A rale road is wan thot has harses on it, an' a railroad is wan thot hasn't, by raison av th' fact thot a harse hasn't th' convayiences fer walkin' on a railroad thot it has on a rale road."—*Judge.*

Lively Experiments.

When Mr. A. W. Gibbs submitted to the Master Car Builders' Association a report on tank cars he said that the inception of this report was an accident in which an entire series of oil-tank cars were in collision, and were subsequently ignited. During the fire which ensued one or more tanks exploded, and it was then discovered that the safety valves with which they were equipped were utterly inadequate to relieve the pressure. The Pennsylvania Railroad was forced into issuing certain regulations and instructions for the equipment of tank cars, and entered into a series of experiments with safety valves, which speedily developed that the rate of evaporation of naphtha was vastly higher than had been anticipated, and that the ordinary rules for safety valves on steam boilers did not adequately apply. At a meeting between the representatives of the Pennsylvania Railroad Company and Union Tank Line Company a plan of experiments was outlined and has been carried on by the Union Tank Line Company at its own expense, involving the destruction of at least seven of the tank cars and at least sixty thousand gallons of naphtha. The experiments were decidedly lively while they lasted, and impressed on everyone the necessity of the recommendations outlined in the report.

Gala Day at Schenectady Locomotive Works.

The foreign delegates to the International Railway Congress have been going through the country in parties occupying special trains that took them to the leading places of interest in the middle and eastern states. One of the largest parties stopped off at Schenectady, N. Y., May 26, and were very hospitably entertained by the American Locomotive Co. officials and by the General Electric Company.

The leading officials of the American Locomotive Company were present at Schenectady to help in entertaining the visitors who numbered about one hundred, representing nearly all countries where railways are operated. We never saw more kindly attention given to doing honor to visitors. Mr. A. J. Pitkin, president of the Locomotive Company, took the lead in this agreeable function, aided by Messrs. J. E. Sague, vice-president; R. J. Gross, second vice-president; Leigh Best, secretary; C. B. Denny, treasurer; H. C. Haquernbourg, purchasing agent; James McNaughton, general superintendent; W. L. Reid, superintendent; A. M. Lane, John Player and other officials.

An exhaustive tour of the works was made by visitors who displayed keen interest in the excellent system of manufacturing locomotives according to the most perfected methods. As the shops site covers 75 acres of land, the tour was a highly strenuous form of sight seeing.

After a thorough inspection of the various shops the fatigued crowd repaired to the Assembly Hall of the works where a sumptuous luncheon was served. After justice had been done to the good things of this life, President Pitkin delivered a cordial address of welcome; and he was followed by W. J. Clarke of the General Electric Company. Earnest responses were made by several of the visitors which indicated that they enjoyed the princely hospitality that had been bestowed upon them during their visit. Attention was directed to work done by Mr. W. F. Allen, secretary of the American Railway Association in promoting the pleasure and comfort of the foreign visitors.

After the luncheon the party were taken by special train to the New York Central's test track where they rode behind the wonderful electric locomotive built for the New York Central, and then disembarking, were afforded an opportunity to see it travel at a speed of 65 miles an hour. The remainder of the day was spent at the works of the General Electric Co., covering over 400 acres of land, having 4,100,000 square feet of floor space and giving employment to 18,000 people.

Busy in Their Machinery Department.

The H. A. Rogers Company report their machinery department as being very busy, and state that they have recently ordered several carloads of machine tools from Cincinnati concerns. These machines are for the Garfield plant of the American Smelting and Refining Company, of Garfield, Utah.

The H. A. Rogers Company also report some very promising inquiries for their machinery department.

The Baldwin Locomotive Works has secured a contract from the Australian government for 20 high-class locomotives. This contract was secured in a competition against bidders from all parts of Europe.

We understand that the Chicago, Rock Island & Pacific System are about to introduce their own refrigerator cars throughout the whole of their lines. That will be a sad blow to the private car monopoly, but it will give the railway increased earnings.

During the month of March the Baldwin Locomotive Works completed 226 new locomotives, which is the largest month's production in the firm's history. In addition, many old locomotives were repaired.

The Second Empire on the N. Y. C.

The Second Empire is a fast passenger train between New York and Buffalo on the New York Central, and the inaugural trip was run on Monday, May 15, without a hitch of any kind. That reads very nicely, and it looks well on paper, but it does not indicate in any way what it really means to put on a new fast passenger train on a crowded road and do it successfully and safely.

There are 440 statute miles between the Metropolis and the city on the Great Lakes, and the run was made with five coaches pulled successively by three 4-4-2 engines at an average schedule rate of 49 miles per hour. The train weighed about 275 tons in all and the engines used were the N. Y. C. standard Atlantic type, having cylinders 20½x26 ins. and 79-in. driving wheels. This train, known on the road as No. 41, leaves New York at 2.30 P. M. and makes its first stop at Albany at 5.20 P. M. Three minutes are allowed for changing engines and the run to Utica takes until 7.14 P. M. One minute suffices, and Syracuse is reached at 8.23 P. M. Three minutes is all the Syracuseans see of the flyer's halt, and the race for Rochester begins at 8.26 P. M. That city is reached at 9.56 P. M. and the start for Buffalo is made at 9.58 P. M., and the terminal is reached at 11.30 P. M., exactly 9 hours from New York. The Second Empire is not quite so fast as the famous Empire State Express, being 10 minutes slower on each of the three divisions than the premier train.

The inaugural run was made under the observation of representatives of thirty-five daily New York and up-state papers with Railway and Locomotive Engineering as representative of the technical press of the country. The party were hospitably entertained in the private car of Mr. C. F. Smith, assistant general superintendent of the road, and Mr. George H. Daniels, the well-known general passenger agent of the N. Y. C., with an able staff of assistants most kindly looked after those who were privileged to participate in what may be called the "inaugural parade" of this remarkable train.

All the way along the line the train was, if anything, slightly ahead of time, showing that the officials had calculated on heavier traffic than the first run brought forth. The trip along the banks of the Hudson was steady and even, each station being ticked off on time and without stop, but when it came to the four level floors of the Mohawk division which the N. Y. C. call their right of way, one or two bursts of speed were shown which proved that the 4-4-2 machines pulling the train had considerable reserve power which will come in handy in heavy weather or on delayed connections.

Mr. C. F. Smith timed a mile or two on what we may call the "level floors," at 74 miles per hour, and notwithstanding that high speed, no hot boxes marred the run, and the manual block system of signals held the space interval intact so that safety had her perfect work, as if no other trains were run on the line, notwithstanding that the Twentieth Century Limited pursued us but 15 minutes behind with untiring persistence.

When the Second Empire got going on the long tangents west of Batavia, we made more than the calculated 49 miles per hour. In places we exceeded the Empire State Express time, and, as Kipling says of the "Purple Emperor," he "layed the miles over his shoulder as a man peals a shaving from a soft board." We rushed up the track so that the western end of the DeWitt yards looked like a string of pearls, flung down by a giant, and on up to Buffalo with an incredible rush, which caused hardly a swing or sway on the splendidly matched right of way which the N. Y. C. calls service track. It was a superb performance. The placing of this train was not, as the public might think, the work of a night. The schedule had been worked out two months previously, checked and rechecked, watched and thought of, and examined after all the engines concerned in pulling it had been tried on locals and freights and expresses, and after overhauling had been made to demonstrate their fitness for fast runs by hard work on the road. Nothing had been left to chance, and the superb performance of May 15 was the result, not of the mere desire to put on a fast train, but the complete trial of railroad rolling stock and power under the most exacting supervision and accurate calculation of which trained railroad minds are capable. The Second Empire is a success, not because railroad operation is easy, but because, as the late Grant Allen has truly said, "Labor, incessant labor, has the appearance of ease."

An electric locomotive built by the General Electric Co., of Schenectady, for the New York Central terminal service between Croton and New York, attained a speed of eighty-three miles an hour one day last month while pulling a heavy train.

China has just granted its first patent. It is for an electric lamp, the inventor of which is an inhabitant of Nankin, the old capital of the Chinese Empire, who calls his lamp the "bright moonlight," and asserts that it is far superior to foreign glow light.

Restricting Movements of Railway Officers Between the United States and Canada.

The Canadian Government have initiated a movement which may have serious results in the relations to railway men employed on lines that pass from the United States into Canada. Officers belonging to the Pere Marquette Railway that were transferred from points in the United States to stations in Canada have been ordered deported by the Dominion Government on the ground that the action violated the alien labor law of Canada.

It looks like a piece of officialism straining the law in the interest of a labor clique. The plan has not worked well for Canadian interests in the first move. Mr. Hunker, manager of the Stores Department at St. Thomas, received an order to return to his own country, which he promptly obeyed, but before going he discharged the four Canadian clerks who had been his assistants. Now he will do the work in Detroit, and St. Thomas people are incensed that their town should suffer because some smart politicians in Ottawa interpreted laws in a senseless fashion.

WORK DONE ON NORTON GRINDING MACHINES.

The Norton Grinding Co., of Worcester, Mass., have issued a catalogue in which, among their other specialties, they mention a 10x72-in. overhead drive grinding machine. A number of other grinders are also catalogued, among which is a gap machine 18 and 30x96 ins. for locomotive work, showing a piston and rod being trued up. These machines are adapted principally for electric drive, and are most useful in railway repairs. Our illustration shows the principal cuts taken from the catalogue to which we refer, and which are framed between two crank pins ground on the Norton machines with ground piston rod in the center, and another resting on the crank pins. There are also two Norton emery wheels shown which are the product of the Norton Emery Wheel Co., of Worcester, Mass., a company which is operated in connection with the Norton Grinding Co. This catalogue will be mailed free to any one who is interested enough to apply to the company for a copy.

Ideal Power is the name of a small monthly magazine or house organ which is issued by the Chicago Pneumatic Tool Co., of Chicago. It is devoted to the compressed air and the electrical appliances manufactured by that company. The May issue, which is No. 2 of the series, has an illustrated article on the "Pneumatic Ram" for breaking staybolts, cutting off rivets, etc. An excellent half-tone shows the ram knocking out cylinder saddlebolts. An article on the Jam riveter expanding tubes by the aid of a sectional tube expander is illustrated in three line cuts showing the method of expanding tubes heading radial stays and holding on to crown bar bolts. There is an article by Lieutenant Godfrey L. Garden on "Industrial Europe," and a fine half-tone of the U. S. S. New York. Also a half-tone from a photograph of the gun crew on board the ship. The men are grouped around a large gun which stands with breech piece open, ready for action. Altogether it is a very interesting and instructive number.

The Master Steam Boiler Makers' Association will meet in convention at the Great Northern Hotel, Chicago, on June 5, to last four days. Everybody interested in boiler construction will be welcome.

The office of Secretary Taylor, of the Master Mechanics' and the Master Car Builders' Associations, has been moved to 390 Old Colony building, Chicago, a very desirable change.

The Westinghouse exhibit at Washington embraced, for the first time, the products of all the associated Westinghouse interests. The Air Brake Company had on exhibition, in addition to its regular apparatus, its new automatic hose coupling device, friction draft gear, compound pump, and motor-driven air compressor. The Electric Company exhibited quite extensively motors for shop tool use, including the smallest machine motors and the heaviest quadruple tool lathes. The multiple unit system of control for electric trains was graphically exhibited on the bottom side of a regular car floor, so elevated that complete view could be had by persons standing on the under side of the car. The Machine Company showed its 300 kilowatt turbine, with inner parts uncovered, in a very effective manner. The Union Switch & Signal Company exhibited its signalling devices comprising both the semaphore and staff systems. The Nernst Lamp Company showed its high candle power incandescent lamps very effectively. The Cooper-Hewett Company made quite a hit with their mercury vapor lamps, especially after the other lights had been turned out. The exhibit was spoken of as one of the best on the grounds and was highly commended by the International Delegates, who plainly took great interest in it.

The J. S. Andrews & Company, of 114 Liberty street, New York, have issued an artistic folder, showing two views of the Andrews Solid Cast Steel Truck Frame. The design of the truck is briefly described by the words used at the head of the pages, solidity and simplicity. The whole truck-side is cast in one piece and the strap which passes under the axle box is hinged to the frame in such a way that when the outer bolt is withdrawn, the strap drops easily away from the box and thus facilitates the removal of wheels. The Andrews truck is in use on a number of roads. In the later designs the frame is lipped down over the outer edge of the axle box, and a reinforced strap below the box is also lipped up, and when the whole is bolted in place a very strong form of construction is thereby secured.

A few physical, competitive and service tests of Falls Hollow Staybolt iron is the sub-heading on a pamphlet which has lately come to our office under the title of "Irrefutable Evidence." This pamphlet, which folds into small compass, has been got out by the Falls Hollow Staybolt Company, of Cuyahoga Falls, Ohio. The introductory pages are devoted to a description of what Falls Hollow staybolt iron is, what the hollow staybolts are, and what they are designed to do. Next follows the experience of an expert, and after that there are twenty-five pages giving records of tests and testimonials. The tests have not only been made by railway companies, but by educational and scientific institutions, which have made investigations on their own account. The Falls Hollow Staybolt Company will be pleased to forward a copy of this pamphlet to any one who desires information on the subject and will write to them concerning it.

Among the books, newspapers, pamphlets, etc., which come to our office, there is one, which may be called a "house organ," that is always interesting. It is *Graphite*, published by the Joseph Dixon Crucible Company, of Jersey City, N. J. The April issue was devoted to the painting of iron and steel structures with the preservative paint manufactured by this concern. The paint is called Dixon's Silica-Graphite paint. A number of bridges are shown in half-tone illustrations, and so are the steel skeletons of many of the large buildings in our cities. The modest iron trolley-wire column is painted with this preservative as well as the steel members of a huge bridge or the frames of a sky-scraper. Two double page half-tones are given showing the Boston & Montana Copper and Silver Mining Company's smelter at Great Falls, Mont., and the Washoe Smelter of the Anaconda Copper Mining Company, at Anaconda, Mont. The steel of the structures in these enormous plants were all painted with Dixon's Silica-Graphite paint. The conditions are very severe at these places, as much sulphurous gas is emitted. Write to the Dixon Company for this issue of *Graphite*, it is given free to those who ask them for it.

The eleventh biennial convention of the Brotherhood of Car Inspectors, Car Builders and Railway Machanics of America was held in Pittsburgh last month, and it was a highly successful meeting. The organization was formed in 1889, at Columbus, Ohio, and George Scott is considered the father. He called the first meeting. The convention of 1893 was held in Pittsburgh. There are 12,000 members enrolled, 1,200 of whom are located in the Pittsburgh district.

Among the participants in the phenomenally large orders for railroad equipment let by the B. & O. Railroad Company this week, is the American Steel Foundries. They will furnish the Baldwin Locomotive Works, for 250 B. & O. locomotives, approximately 15 tons of steel castings for each engine, including engine frames, driving wheel centers, cross heads, driving boxes, etc.,

etc. One of the large orders recently received by this company was for 3,000 R. E. Janney couplers to be applied to 1,500 cars to be built by the Pressed Steel Car Company for the Chesapeake & Ohio Railway. Also an exceptionally large order for 6,000 of these couplers, for application to 3,000 Lehigh Valley cars, has just been awarded to the American Steel Foundries.

To take care of their fast increasing business, this company are making additions and improvements to their various plants, and hereafter they will be better equipped than ever to handle their business.

Inspection of Locomotive Boilers Compulsory.

The railroad brotherhoods have won a victory in New York State over the railroad companies in pushing into law the Bedel bill, providing for the inspection of railroad locomotive steam boilers, under the supervision of a State inspector. The bill had the support of the Brotherhood of Locomotive Engineers and Firemen and was opposed by the railroad companies. In approving the bill Governor Higgins filed a memorandum in which he says:

"Many accidents, of which the engineers and firemen are almost invariably the victims, have resulted from explosions of locomotive boilers. Reasonable requests for legislation calculated to reduce the risks of necessarily hazardous employments are entitled to considerations."

In following its policy of monopolizing all competitive transportation mediums the New York, New Haven & Hartford Railroad Company has after many years sustained a defeat. The company had obtained control of the Springfield Street Railway and the Attorney General of Massachusetts has declared the action to be illegal and may invoke action by the courts looking to the nullification of the transaction or the forfeiture of the New Haven charter in Massachusetts.

A catalogue has recently come to us which illustrates the work of the Westinghouse Companies in railway and industrial fields. It is most artistically printed on heavy plate paper, and the various half-tones are artistically arranged, and are of excellent quality. Beginning with an introduction, the catalogue goes on to enumerate the various appliances manufactured by the Westinghouse Air Brake Co., The Union Switch & Signal Co., The Westinghouse Electric & Mfg. Co., The Westinghouse Machine Co., Westinghouse Church-Kerr & Co., The Cooper-Hewitt Electric Co., the Sawyer-Mann Electric Co., the R. D. Nuttall Co., The Nernst Lamp Co., The Pittsburgh Meter Co., and the Canadian Westinghouse Co., Ltd. The book closes with a map showing the location of the various works belonging to this concern which are situated in Pittsburgh, Pa. The book is a short epitome of all kinds of products made by the Westinghouse Co. and is well worthy of perusal. Application to any of the Westinghouse Companies will be sufficient to secure a copy of the catalogue.

Dissect a Cockroach.

In the days when the now generally accepted doctrine of evolution was fighting hard for a foothold against all sorts of beliefs both religious and scientific, the late Professor Huxley was one of its most conspicuous champions. Herbert Spencer called evolution, when applied to organic nature, the law of the "survival of the fittest," and Huxley defended this view against all comers.

On one occasion a clergyman, who did not believe in evolution, as we know it, endeavored to trip up the learned professor by writing to him that he, the clergyman, had read with deep interest all that had been written on the subject, and that he still desired light, as he could not grasp the arguments used. Huxley, who had a pretty good idea that the man's object was to prolong the argument, and not to learn anything, wrote him a post card on which he said, in effect: "If you want to get a working knowledge of biology, dissect a cockroach!"

It is not possible for a great many of us to literally do this, but we can most certainly follow the general scope of Huxley's advice—we can add to our stock of knowledge on the subjects which concern us, by reading. Engineering and modern engineering science are within our grasp and will be as long as books are written or printing presses revolve. No one can sit still and grow wise. We must all go after knowledge with as much earnestness as if we had been set the task of dissecting a cockroach for the purpose of learning its bodily structure. This does not mean tearing the insect to pieces without rhyme or reason; it was Huxley's method of emphasizing the necessity of systematic study. We offer to our readers what we consider facilities for prosecuting this kind of study which will produce results. Look over our list and dissect it if you like.

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and children see it.

"Twentieth Century Locomotives,"

Angus Sinclair Co., deals comprehensively with the design, construction, repairing and operating of locomotives and railway machinery. First principles are explained. Steam and motive power is dealt with; workshop operations described, valve motion, care and management of locomotive boilers, operating locomotives, road repairs to engines, blows, pounds in simple and compound engines; how to calculate power, train resistance, resistances on grades, etc. Shop tools explained. Shop receipts, definitions of technical terms, tables, etc. Descriptions and dimensions of the various types of standard locomotives. The book is well and clearly illustrated and is thoroughly up to date in all particulars, fully indexed. Price, $3.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." Price $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. We sell it for 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. It sells for 75 cents.

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"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion, it is easily understood by every intelligent fireman. The price is 50 cents.

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"Standard Train Rules." This is the code of train rules prepared by the American Railway Association for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotive, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

It's no use bragging of your ancestors unless they would feel like returning the compliment.

A recent press dispatch says: "With the arrival in Los Angeles of several locomotives of the most powerful type, the Southern Pacific is preparing to experiment with freight trains of fifty cars, instead of thirty, the maximum now used. The object is to economize in the cost of operation by decreasing the number of train crews. The new service will be in effect as far east as El Paso, and will not include the northern lines out of Los Angeles, owing to the steep grades involved." There are other incidents connected with increasing the weight of freight trains that are not conducive to profit. These are break-in-twos, wrecks and delayed movement of trains. The general superintendent of an Eastern railroad recently increased the weight of trains 25 per cent., and trebled the time required to get a train over a division. When the road was congested with cars the G. M. had to step in and cut the train loads in two till the blockade was raised.

During the year 1904 the Safety Car Heating and Lighting Company of New York equipped 3,084 cars, 60 buoys and beacons in the United States and Canada with the Pintsch lighting system, and 1,624 cars were equipped with the company's standard systems of steam heating. The Pintsch system of lighting, which is handled by this company, has been adopted by over 200 railroads in the United States, Canada and Mexico, where it is applied to 25,500 cars and 450 buoys and beacons. The steam heating systems of this company have been adopted by over 150 railroads in the United States and applied to 16,000 cars. Up to January 1, 1905, the Pintsch system of lighting has been appiled to 134,900 cars, 6,200 locomotives and 1,516 buoys and beacons throughout the world.

It is expected that a new roundhouse and enlarged shops will be built this spring and summer at Dennison, Ohio, at a cost approximating $300.000 if the present plans of the Panhandle officials are carried out. The recommendations concerning the new work to be done on the Pittsburgh Division of the Panhandle are said to entail a much larger amount, several millions being involved. The new work at Dennison, however, is among the most important improvements to be taken up by this line during the season.

The 1905 Car Interchange Manual, got out by the McConway & Torley Company, of Pittsburgh, contains, with the supplement just issued, a brief abstract of the M. C. B. Arbitration Committee's decisions on car interchange disputes from 1 to 682. The essential features of each case are given with the decision, and the reason why decision was rendered. In the back of the book are useful data for carmen and others, a few plain instructions regarding first aid to the injured, and there is a complete index. This makes the book, which is of pocket size, a very handy companion for the man who desires to keep "posted" on matters appertaining to car interchange. In a former notice we said the book cost 25 cents. We are informed by the McConway & Torley Company that it is issued with their compliments to their friends.

Our manufacturers of railway appliances have not been greatly enriched by the International Railway Congress, but a few orders have been received from the visitors. A visitor of the Great Central Railway, of England, placed with Wm. Sellers & Co., of Philadelphia, a large order for shop tools for its car and locomotive repair shop.

Those who enjoy the acquaintance of President Underwood, of the Erie, are aware that he never wastes breath to call a spade a horticultural implement. So when the allegation was made at the Interstate Commerce Commission inquiry, that the Erie was paying $10 a car rebate to the private car lines, Mr. Underwood said: "Any statement that the Erie is paying rebates for private car traffic is an aboslute and unqualified lie."

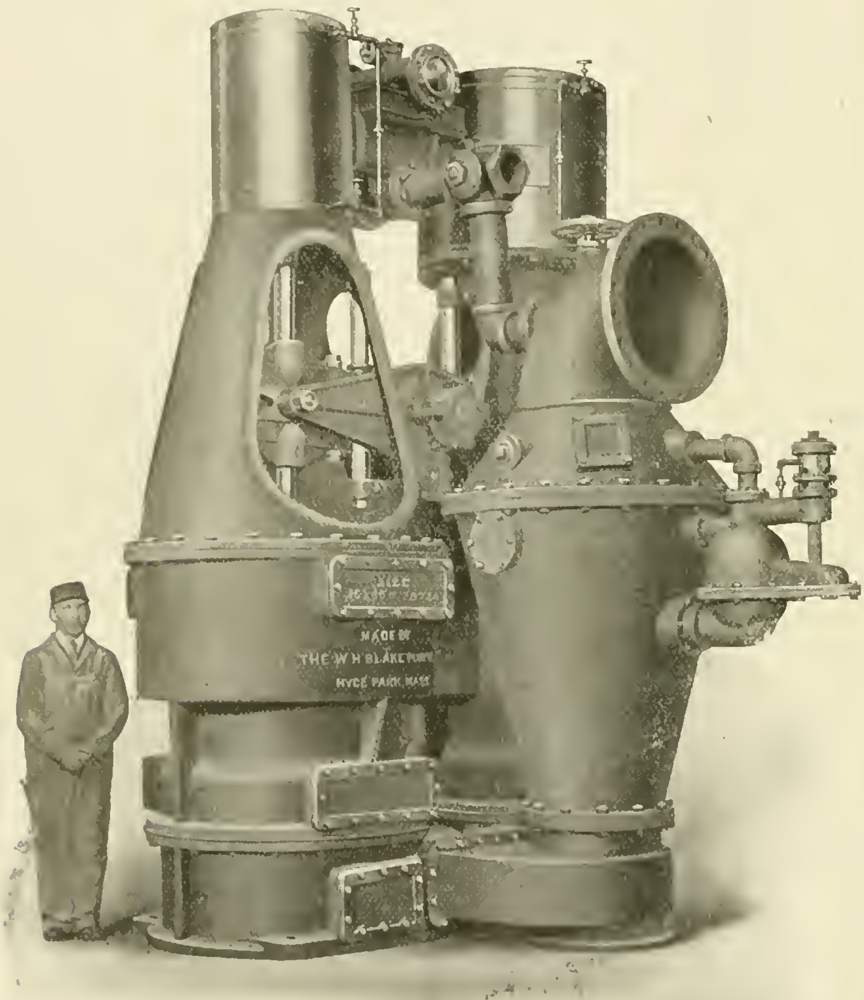
After most of our June issue was on the press we received the Electricians' Handy Book, by Prof. T. O'Conner Sloane. Prof. Sloane's name on the title page of a book is a guarantee of its value, and as far as we have been able to examine this work it seems a credit to its distinguished author. We will review it in a future issue. The book is published by Norman W. Henley, New York. Price, $3.50.

The trend of fashion that led to the ordering of piston valves very frequently a few years ago, does not seem to thrive very well. The Baltimore & Ohio people ordered a lot of new locomotives lately and none of them will have piston valves. All the locomotives ordered by the Panama Canal Commissioners will have ordinary slide valves.

On the afternoon of May 22, a freight engine newly out of the repair shops at Columbus, O., exploded the boiler, killing six men and injuring a seventh. We suppose the usual excuse will be low water, but we are inclined to suggest safety valves improperly adjusted, or some villainous boiler work.

New Type of Blake Condenser.

A feature of the old time compound engine was the somewhat cumbersome direct connected air pump. In modern practice this device, in connetion with an independent condenser, is designed to be placed at any convenient point and to operate at any speed independently of the main engine. Choice may be readily made between the surface or jet type of condenser, largely dependent upon whether the condensed steam is to be returned direct to the boiler or not.



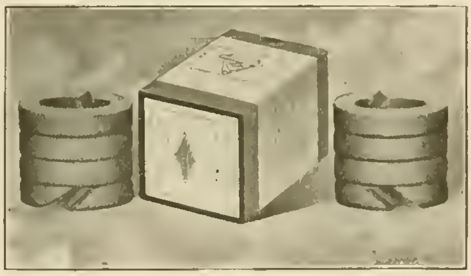
BLAKE CONDENSING ENGINE.

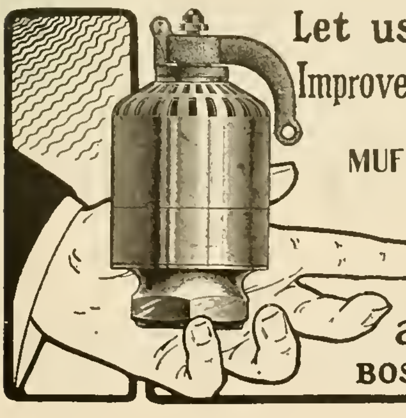
A complete line of independent jet and surface condensers has just been perfected by the W. H. Blake Steam Pump Co., Hyde Park, Mass. These range in capacity from 600 to 40,000 pounds of steam condensed per hour with injection water of 70 degrees F. Our illustration is representative of its class.

In this form of twin vertical air pump and jet condenser the air pump is made with compound steam cylinders when it is to be operated for condensing, and with tin vertical steam cylinders when operated as non-condensing and with exhaust steam utilized. Being vertical in construction, all pistons wear equally on all sides.

The amount of water passing through the condenser is regulated by the vertical adjustment of the injection cone which acts as a nozzle to form a thin spray which is thrown out at an angle of 45 degrees. This falls upon a succession of shelves, thus forming secondary sprays through which the exhaust steam from the engine must pass. Instantaneous condensation results with great economy in the use of water. A perforated copper plate is substituted for the shelves when the force of the injection water is not sufficient to produce spray. The combined volume of injection water and condensed steam flows by gravity through the bottom of the condenser into the pump. To prevent flooding of the engine the condenser is provided with an independent vacuum breaker attachment secured to the side of the condenser. This is so arranged that when the water reaches the level of the float chamber the float is raised and by great leverage forces the check valve from its seat, allowing an inrush of air which instantly breaks the vacuum, thus preventing further suction of water into the condenser and consequent flooding of the engine.

The Espen-Lucas Machine Works, of Philadelphia, have issued a catalogue which deals with cold saw cutting-off machines, boring and milling machines and automatic saw sharpening machines. There are seventeen varieties of cold saws all illustrated with explanatory letter press immediately following. A hand saw-sharpening machine and two automatic saw sharpeners are catalogued and explained after which follow a horizontal tool room boring machine, a horizontal floor boring, milling and drilling machine, and a plain slab milling machine. Information is given concerning all these machines in the catalogue, and the company will be pleased to send this catalogue free to any one who will apply to them for a copy.





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Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVIII. 136 Liberty Street, New York, July, 1905 No. 7

Fastest Trains in the World.

BY ANGUS SINCLAIR.

The indications are that we will see some very fast train running in this country within the next few months. The Vanderbilt Systems have been running a very popular train between New York and Chicago, called the "Twentieth Century Limited," which made the run in twenty hours, and recently intimation was given that the time would be reduced to nineteen hours. This appears to have stirred the Pennsylvania people, for they gave notice of a limited that would be run between New York and Chicago in eighteen hours, and now the Vanderbilt lines have determined that their "Twentieth Century Limited" will make the run in eighteen hours. The distance from New York to Chicago by the Pennsylvania Railroad is 905 miles, which will require an average speed between starting and terminal points of 50.3 miles an hour exclusive of stops. The distance by the New York Central and the Lake Shore is 959 miles, making the average running speed 53.3 miles per hour.

PENNSYLVANIA EXPRESS TRAIN, WITH EXTRA CAR, RUNNING SIXTY-FIVE MILES AN HOUR.
(Type of locomotive that pulls 18-hour New York-Chicago trains.)

The problems of pushing through these trains punctually every day on the limited time scheduled constitute the most strenuous work that railroad men have ever undertaken; and their successful consummation will add new laurels to American railroad management. The speed is not so excessive, for the Empire State Express has long been run on that average schedule, and for a long stretch maintains a speed over 60 miles an hour, but the extremely long journey is what strains all concerned, for keeping that length of road free from obstruction at certain times of the day is a stupendous task.

The sentiment which influenced the managers of these through lines to introduce these extremely fast trains is the desire for racing, common to all animals, and most thoroughly developed in human beings. The locomotive had scarcely passed the trials which demonstrated that it would go, when people wanted to test its speed capabilities. Immediately before trials of locomotives were made on the Liverpool & Manchester Railway, the humorists of the day found no end of fun in the prediction made by a friend of the locomotive that the engine might run at the rate of ten miles an hour, yet the best engine made 29 miles an hour, and immediately the demand arose of a sixty-mile-an-hour pace. A mile a minute appealed to sentiment, the measure was easily remembered, and no ordinary high-speed inclined person would be satisfied with less.

When a fast train has to be run only about one hundred miles the task is generally easy, for there will be few interruptions of speed; but when ten times that distance has to be run, spurts of extreme velocity are necessary to overbalance inevitable delays. Therefore an average over ten miles above the running speed must be maintained, which will be increased as much as the capacity of the motive power will admit on occasions when delays have been encountered. Newspaper reports, which are notoriously unrelaible concerning high train speeds, have been telling about amazing speed attained by the two trains, and the train dispatcher's sheets indicate that from 80 to 100 miles an hour has been made, which is remarkable even for short runs like the Atlantic City express.

Ever since railways began operating attempts have been made to maintain excessively high train speeds, but it is only within the last ten years that locomotives have been developed which would haul a paying train at sixty miles an hour. As early as 1838 one of the engines illustrated on this page, which had driving wheels ten feet in diameter, was tried on the Great Western Railway of England, but it was a rank failure. The ambition for high train speed has prevailed for many years in Great Britain, but the practice is an expensive luxury.

In 1845 President Stevens, of the Camden & Amboy, the first link of the great Pennsylvania System, visited Europe and was so much carried away with the high speed engines seen there that he ordered his superintendent of machinery to have the engine built which is illustrated on this page. The engine was a failure because the boiler was too small to supply the cylinders with steam. This was the weak point of all the early high speed locomotives in every country where they were tried. The designers worked on the principle that the size of driving wheels measured the speed power of the engine instead of the capacity of the boiler to generate the steam required to keep the driving wheels turning. That was a discovery that came on the path of numerous failures.

The old high speed locomotives could not be depended upon to haul a train heavier than the engine at a speed of 60 miles an hour. Modern high speed locomotives, with their huge boilers, can be depended upon to haul a train three times their own weight at 60 miles, which enables the owners to put behind them a paying load. When the New York Central people first made the trials of train speed that resulted in the introduction of the Empire State Express, they worked to find out the load that the engine would haul, and to make certain that it would pay. The improved locomotives now in use haul a paying load, even with extraordinary heavy dead weight per passenger carried.

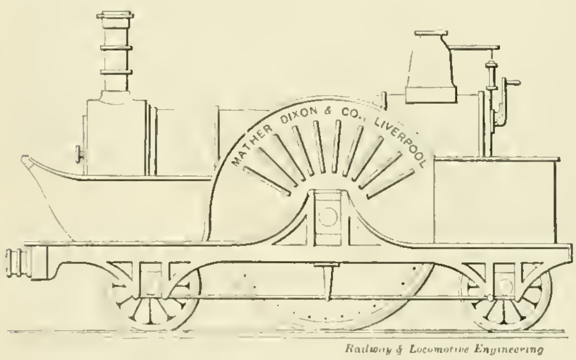
There is some vague talk heard about still further reducing the time of the fast New York-Chicago trains, but we do not believe it can be done with a paying load, and that is the real limit of competition.

Since this article was on the press, the 18-hour train of the Vanderbilt lines met with a terrible accident by running over an open switch, and the time between New York and Chicago has been extended to 20 hours.

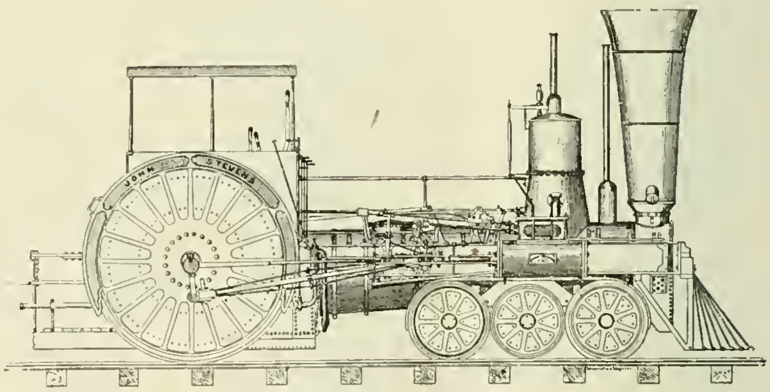
The Railroad Mechanical Conventions.

When the Joint Committee of the Master Car Builders and Master Mechanics' associations decided to hold the 1905 conventions at Manhattan Beach, Long Island, there were fears seriously expressed that the meetings would be less successful than they have been of late years when held at Saratoga. Objections were raised to dividing the people into parties to occupy three hotels, and fears were expressed that the attractions of the neighboring pleasure resorts would divert the members away from the technical meetings. The conventions went off very harmoniously, there seemed to be little inconvenience experienced from the members being separated in different hotels, and the technical meetings were never better attended, not only at the opening of the sessions, but right through until a motion to adjourn was carried on the last day.

That so few complaints were heard about inconveniences endured was highly creditable to the good nature of the people in attendance at Manhattan Beach, for it proved to be much less than an ideal place to hold such meetings. The only source of satisfaction seemed to be that the organizations proved that they were not tied down to Saratoga. An impression has been growing for several years that the hotel keepers of Saratoga were beginning to



GREAT WESTERN RAILWAY OF ENGLAND, 1838. DRIVERS TEN FEET DIAMETER. WIND SPLITTER IN FRONT.



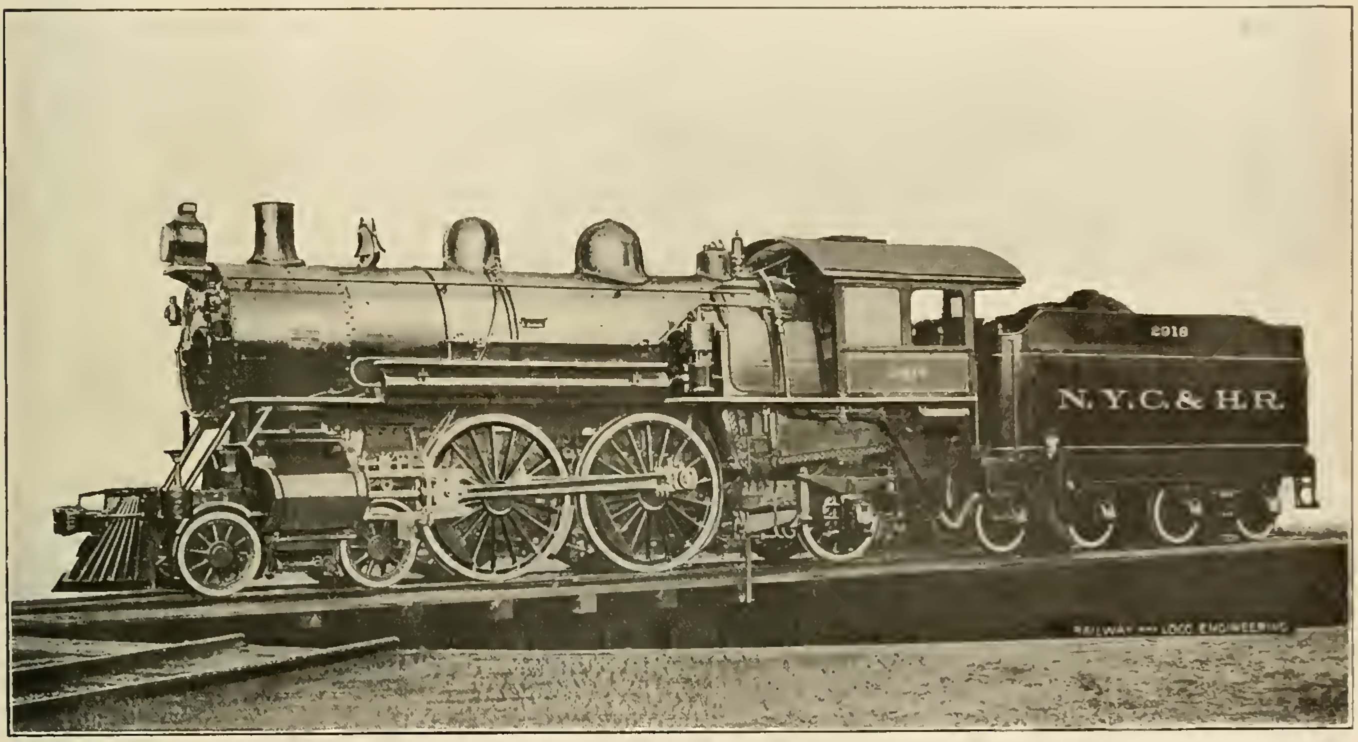
CAMDEN & AMBOY RAILROAD CRAMPTON ENGINE, 1845. DRIVERS EIGHT FEET DIAMETER.

imagine that they owned these conventions, and the service accorded was deteriorating every season. Going elsewhere has proved that Saratoga is not a necessity for the railroad mechanical conventions, and it may lead to better service in future when the conventions go there.

The papers presented and the discussions which followed their introduction were of a very high order of merit, and would be a credit to any engineering body. We here present some outlines of the proceedings.

FIRST SESSION MASTER MECHANICS' CONVENTION.

The thirty-ninth annual convention of the American Railway Master Mechanics' Association opened in the meeting hall of the Oriental Hotel,



TYPE OF ENGINE USED, PULLING 18-HOUR TRAIN OVER VANDERBILT LINES.

Single expansion cylinders, 20½ x 26 inches; driving wheels, 79 inches diameter; heating surface, 3,455 square feet; grate area, 50.32 square feet; steam pressure, 200 pounds; weight of engine, 176,000 pounds; tractive power, 23,000 pounds.

Manhattan Beach, N. Y., June 14, 1905, with President Peter H. Peck in the chair.

The meeting was called to order at 10 o'clock and President Peck delivered his address to the convention. He stated that for several years there had existed a feeling that a consolidation of the Master Car Builders' and Master Mechanics' associations should be effected. The executive committees of both organizations held a joint meeting in New York last December with a view of thoroughly discussing and considering the subject. The advantages and disadvantages were carefully weighed, and it was the unanimous opinion of the members of both executive committees that nothing could be gained by any closer relations than now exist between the two associations.

An interesting and unique statement was made by President Peck that there are at the present time in this country 47,474 locomotives, having a total grate surface of 1,342,578 square feet or about 31 acres of grate surface. The heating surface of these locomotives amounts to 78,686,339 square feet or about 1,809 acres.

He touched on the fact that the larger the grate area of a locomotive, the greater is the coal consumption, much of which is caused by cleaning fires, drifting, delays on side tracks and at terminals.

President Peck also called attention to the fact that while the motive power equipment was being rapidly increased to meet the greater demands of daily railway traffic, the shop facilities for keeping these locomotives in repair had not kept pace with the former practice. He heartily urged that a greater amount of attention be given to modern railway shops and their equipments.

He expressed a preference for the return to the use of a simple, practically designed and constructed locomotive, and believed in the elimination of individual preferences, patented devices, fads and frills which have no real value, believing that the simple, practical locomotive would produce more satisfactory results. He believed that decrease in efficiency had resulted from the irregular transferring and crewing of locomotives for long runs, and that the regular assignment of locomotives to individual crews would bring better results. He expressed a belief that the pooling of locomotives is not economical either in fuel, repairs, or maintenance, especially on an ordinary sized road.

The secretary's report showed the association to be in a very healthy condition, their being a total membership of 793. The treasury showed a balance on hand of $1,553.29.

TONNAGE RATING.

The first technical paper discussed was that on Locomotive Loading, and was presented by a committee headed by Mr. C. H. Hogan, of the New York Central. The report brought out much interesting information. One member believed that the rating should be governed by the amount of traffic and the importance of the trains, and be determined jointly by the operating officer and the representative of the locomotive department, thus enabling the service to produce the highest revenue to the road; and as a fixed rating would not be applicable to the different existing conditions, the rating should be left to the representative officers of the road or division on which the locomotives are employed.

It was believed that the convention assembled could not give an established rating for the locomotives that would be applicable to all the different classes of services on roads throughout the country. It was believed that that point was one which would be best worked out by the representatives of the different divisions.

OBSERVATION CAR, PENNSYLVANIA SPECIAL.

An important question was advanced whether the excessive lengths to which tonnage rating has been carried was really economical; also whether some information could be had from a number of roads as to the present maximum tonnage that could be economically handled by the engine.

One member stated his belief that the complaints that had been made against excessively heavy tonnage were largely on the motive power side, from a desire to avoid troubles.

In certain portions of the country it was found to be a practice that reductions in tonnage had been made on account of the condition of the locomotive. In other parts of the country it was expected that an engine would always be in a position to haul her tonnage; if she were not, and if there was any failure of the engine to haul her full tonnage, the fact was referred to the motive power department.

A spirited discussion followed on the point of whether it was really economical to shop an engine at a point where she began to "fall down" on her tonnage, or whether it would be better to give her a secondary rating and reduce her tonnage. This latter proposition seemed to receive support from the practice that engines are frequently shopped at the beginning of the winter to be put in first-class condition to haul full tonnage, and if the shop is unable to take her at that time, she was given reduced tonnage until she could obtain entrance to the shops.

It was thought that the arrangement of the tonnage schedule of the transportation department, without going into the matter thoroughly with the motive department, was wrong and very often resulted in false economies.

SMOKING CAR, PENNSYLVANIA SPECIAL.

One member had observed that some high officials have an idea that there is nothing like a very heavy tonnage, and the division superintendent who hauls the greatest number of tons usually receives complimentary letters, whereas another superintendent may be transporting his goods at a lower cost per mile, and yet, if his trains are light by a few tons, he may not get the complimentary letters which were sent to the other man. Excessive tonnage does not always mean economy.

A prominent Western member advised that his experience had shown that the economical loading of the engine lies somewhere about the load where she can make ten or fifteen miles per hour. He further believed it false economy to load the engine so she cannot make that as a minimum speed.

It was believed that enough attention to the question of the cost of operating trains was paid, the wages of the train men, as well as the wages of the engine men, and the cost of coal did not always appear in the calculations of economy.

WATER SPACES AROUND FIRE BOXES.

This paper was presented for topical discussion by Mr. L. H. Fry, of the Baldwin Locomotive Works, with the view of bringing out in the discussion the best known dimensions to produce a minimum consumption of fuel and replacement of fire box sheets and reasons for the same.

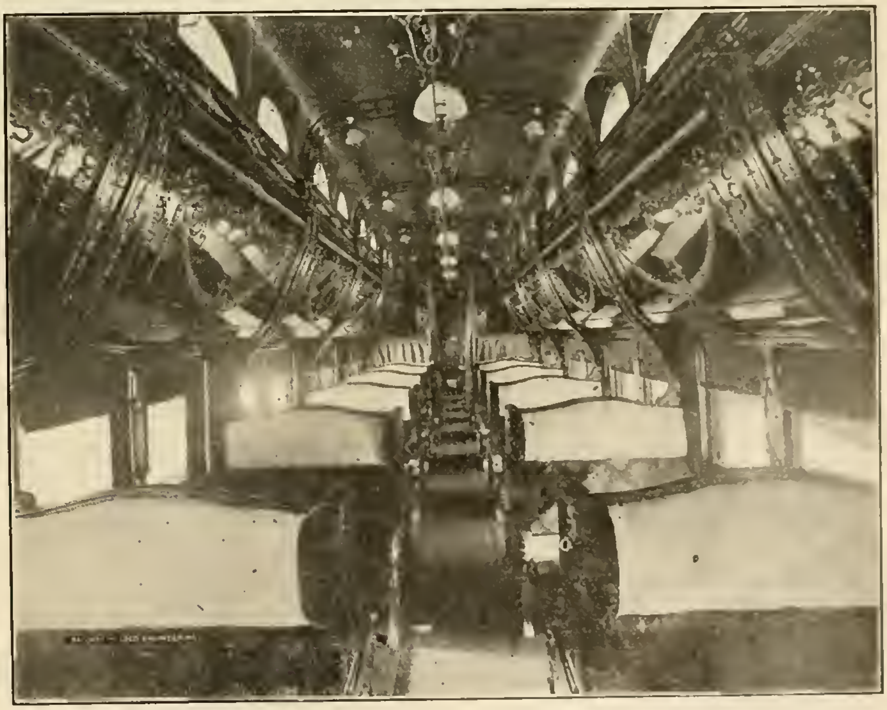
"In endeavoring to discover what is known on this subject," said the writer, "I made an examination of the water space dimensions of some 84 boilers. This investigation showed that there is no general recognizable rule connecting the size of the water space with the fire box dimensions, but that there is an increasing tendency to use wider water spaces. So many reasons for the use of the wider water space can be brought forward that it seems strange that the width has not been increased

DINING CAR, PENNSYLVANIA SPECIAL.

more rapidly. When the fire boxes were restricted in width, by being placed between the wheels, the necessity of obtaining all possible grate area made it desirable to keep down the width of the water space to a minimum. Now, however, with the wide fire boxes above the wheels, there is but little excuse for reproducing these cramped water spaces. A free increase in the width of the water space around the fire box increases somewhat the dead weight of the engine, but the advantages to be gained will undoubtedly more than offset this."

The discussion of the subject developed the conclusion that a free circulation of the water will be ensured by wide water legs, and will largely assist the evaporative power of the fire box heating surface. The increased size of the water spaces has considerable influence on the evaporation and life of the sheets.

The question of proper circulation of the water received considerable attention. It was the consensus of opinion that the narrowest part of the water space should be on the mud ring portion, and the water space be gradually increased as it went upward, being the largest at the top. The discussion proved that the fire box sheets should have sufficient vertical slope to permit the steam bubbles to liberate themselves and rise perpendicular through the water unimpeded by the downward current of the cold water. If an impediment was furnished by a decreased width of the water space, as the steam bubbles traveled upward, the cold water would be retarded in its passage downward, and circulation would be restricted to a degree which would permit of undue heating of the fire box



SLEEPING CAR, PENNSYLVANIA SPECIAL.

sheets and consequent ruining of those sheets and stay bolt ends.

Valuable experimental vibration tests had been made to determine the effect of greater length of stay bolts and wider water spaces. When an increase of 60 per cent. was made in the length of the stay bolt, more than 130 per cent. was added to its life.

SUPERHEATED STEAM.

The next paper, on Superheated Steam in Locomotive Work, by H. H. Vaughan, proved to be one of the most interesting and carefully prepared papers yet presented to the association. Mr. Vaughan took up the subject in a historical and theoretical way and proceeded to modern designs of the superheater device. The smoke box form of superheater and the form which is located in the middle of the boiler seemed to be the two forms most practical for locomotive service. The saving of fuel on locomotives using such devices was computed by the author of the paper to be about 10 or 15 per cent. when the device was in good repair and in maximum operative condition.

In the discussion which followed the belief seemed to prevail that undoubtedly the adaptation of this device to locomotives would accomplish a considerable saving, even if the first cost of installation of the device might be considered high. Good points were also brought out, showing that the apparatus would require considerable care, and if allowed to degenerate in condition the good results would be entirely lost, and the device be an expensive and useless addition to the locomotive equipment. Altogether it seemed that the device contained sufficient merit to warrant its being placed in modern locomotives, which is now being done in different sections of the country.

The convention adjourned to meet the following morning at 10 o'clock.

LOCOMOTIVE FORGINGS.

After the preliminary work of the morning had been cleared away, the paper on Locomotive Forgings was taken up and discussed. This paper entered into the testing of metals, and contained three important specifications, one for locomotive driving and engine truck axles, another for locomotive forgings, and the third for steel blooms and billets for locomotive forgings.

SHRINKAGE OF DRIVING WHEEL TIRES.

The next subject taken up for discussion was the shrinkage allowance for locomotive driving wheel tires. Very soon after the reading of the paper the discussion developed the fact that the actual subject of shrinkage was not so much concerned as was the lighter cast steel wheel centers now being used by various railroads. There seemed to be a demand for a wider wheel rim on which to shrink the tire, and at the same time the cross section of the spokes of the wheel demanded an enlargement over the present dimensions. The present cast steel wheel center could not hold its tire as did the cast iron center.

After considerable discussion the matter was referred to a committee to report on the revised dimensions of wheel centers, etc., which would ensure a greater freedom from loose tires on cast steel wheel centers, and prevent the buckling of the spokes complained of.

TERMINAL FACILITIES.

The next subject taken up was that on Locomotive Terminal Facilities and Methods of Heating and Ventilating Roundhouses, by Donald R. McBain, of the Michigan Central Railroad.

There seemed no doubt that present terminal facilities, especially roundhouse facilities, were lacking on the average railroad, and that these facilities might be very greatly increased and bettered to the advantage of the railways. The better location of coal chutes, ash pits and turn tables were badly needed. The heating and ventilation of the round house occupied a considerable portion of the discussion. The consensus of opinion of the speakers seemed to be that the better means of heating and ventilating the round house was by the hot air blast system. That system of introducing warm air through conduits to the pit and allowed to pass upward and out at the top of the round house was most advantageous. Especially is this true in the winter time, when the engine comes into the round house coated with ice and snow. One member stated that fifteen minutes after the arrival of the locomotive in the pit equipped with the hot air conduits the ice and snow would begin to melt and drop from the wheels and other parts to the pit, thus clearing the parts of snow and ice and opening up all of the oil holes.

TECHNICAL EDUCATION.

The paper on Technical Education of Railway Employees, presented by Mr Basford was one of the most important of the present convention. The paper showed every evidence of careful investigation of the subject and the collection of matter. The author argued in favor of technical education for the railway employee, and outlined systems of teaching whereby the employee could receive a good technical education by attending night school, where he could learn drawing and other things advantageous to him in his work.

One member stated that his road conducted a carefully arranged instruction system with the employees, taking care to learn whether the employee had studious habits or not. Another advised that preference be given to men who were known to be seeking a technical education through correspondence schools and educational papers. He believed the latter course was one of the best possible to pursue.

The meeting then adjourned until Friday morning.

(*Continued on page 335.*)

No Such Thing as Poor Coal.

From remarks made by Mr. T. F. Adams, general master mechanic of the St. Louis Southwestern, at the Master Mechanics' Convention, we conclude that firing locomotives has become a fine art on the Southwestern. Mr. Adams said: There is nothing in the country to-day in the operation of railroads that is of more interest than the question of fuel. The education of the engineer and the fireman in the use of fuel is one that does away with the setting out of trains, engines failing on the road, delays on cinder pits, cleaning fires, etc. It has been demonstrated beyound a reasonable doubt that the excuse of an engine failing on the road because of poor fuel is not tenable from the fact that there is not any fuel used in the country to-day that I know of that, if properly used, will clinker, and I believe the word clinker is not the proper word to be used in connection with the sand pit. It should be ashes. As a matter of fact, if the cinder is burned up there will be no lumpy material. We all agree where our trains are delayed from two to three hours, as the case may be, on account of engines not steaming, poor coal, etc., it is a serious difficulty to the management, as well as a source of annoyance to the motive power officials.

On our road we take into consideration the education of the engineer and fireman in the fuel question. We adopted a method under which, if the engine loses any time on the road due to the engine not steaming, we bring the engineer and fireman into the office and ask each the cause. If the statement is made that it was on account of poor fuel, we ask him to explain what he intends us to understand when he says poor fuel, and in that manner we bring out his idea of it and instruct him accordingly. It has had a wonderful effect—the effect has been that we have run our 20-switch engines, 20x26 engines, four days and four nights without cleaning the ash pan, and we have shaken down the fire out of the engine in 15 minutes. We have run a 20-inch engine on the road on a run of 250 miles with Illinois coal, and have not shaken the grates or cleaned the ash pans, and at the expiration of the trip we have shaken down the fire out of the engine in 15 minutes.

I believe to-day that one of the most important subjects for this convention to consider is the intelligent use of fuel, not the economical use of fuel, because intelligent use of fuel results in economy.

Easy Way of Handling Ashes.

The troublesome problem of handling ashes at fire cleaning pits appears to be thoroughly mastered by Mr. John J. Ellis of the Chicago, St. Paul, Minneapolis & Omaha. During a discussion at the Master Mechanics' Convention Mr. Ellis remarked:

We handle our ashes by a depressed track, going into the roundhouse. We have a drop pit, with buckets underneath, but on a portable truck. The truck runs down an incline, and when the bucket is filled with ashes the bucket and the truck runs down the incline and is lifted by a pneumatic hoist and run over to the car. The fulcrum is so arranged that the bucket will dip very easily. I think that is about the best system I have seen in my travels. It does not cost anything, either. At our place the dispatcher's helper empties the buckets. He also fills the buckets from the ash pans. We used to have to shovel the ashes from the ground into the car, or at least from one part of the ground to another place, and we save considerable money by the arrangement we have now. I have eight terminals on our road equipped with this same device. There is a drum which is built up from the depressed track, and it extends over to another track where the car is, and we have a vertical and a horizontal cylinder. Just let the man run the car over, and it is no trouble at all. It is a perfect success on our road and very economical. It saves us lots of money in a month. We have three cars, and when they are loaded they are just hauled away and another three are put in place. The system appears to work very nicely.

Baldwin's 4-6-2 for Oregon Railroad and Navigation Co.

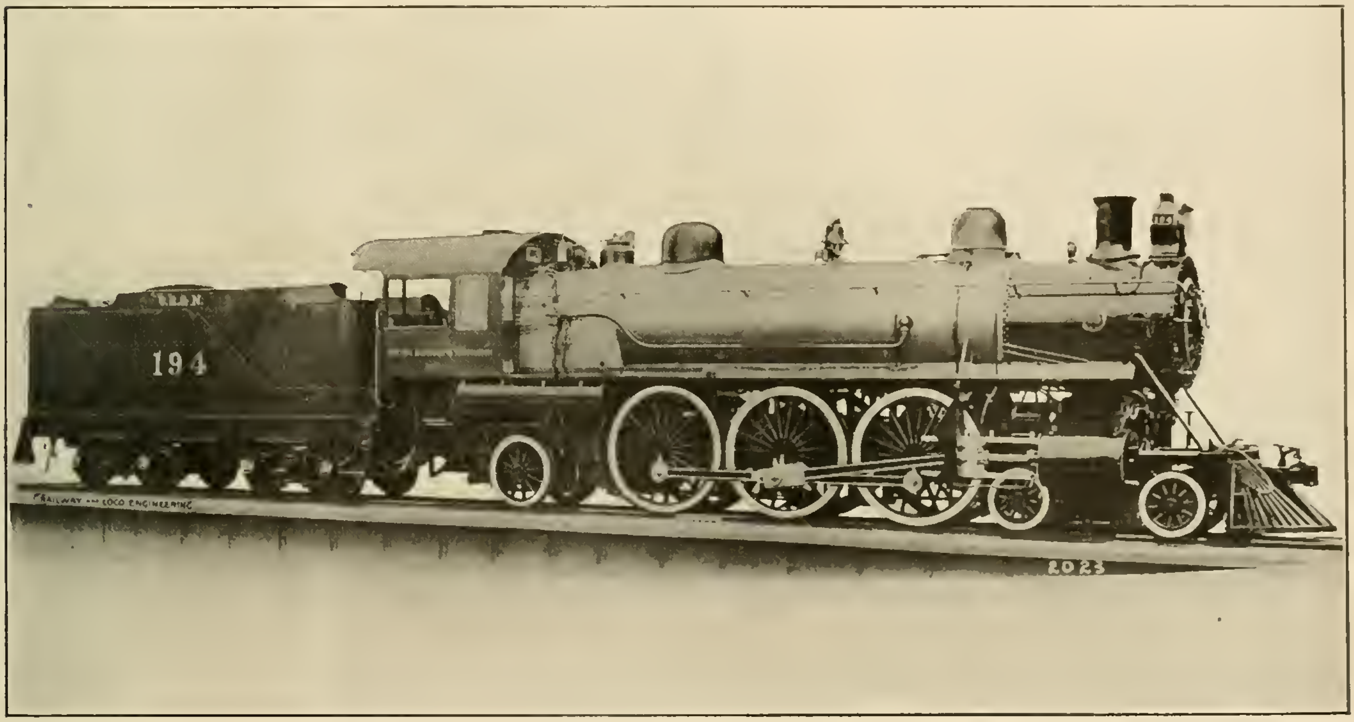
The annexed engravings illustrate a very powerful type of balanced compound locomotive recently built by the Baldwin Locomotive Works for the Oregon Railway & Navigation Company. It is of the Pacific pattern, and is adapted for hauling heavy passenger trains over a hilly road at moderately high speed.

Calculating the various particulars of the engine will show it to be very well proportioned for the power to be exerted. The traction power is a little over 28,000 lbs., the ratio of adhesion to traction is a little over 5, and there are 61.6 sq. ft. of heating surface to one foot grate area.

The high pressure cylinders are inside the frames. By a very courageous act of designing, the main rods span the forward axle by a bifurcated opening. The engine was on exhibition at the railroad convention at Manhattan Beach and attracted much attention from visitors.

Annexed is a few of the leading particulars of the engine:

Gauge, 4 ft. 8½ ins.
Cylinder, 17 ins. and 28 ins. x 28 ins.
Valve, balanced piston.
Boiler—Type, straight; material, steel; diameter, 70 ins.; thickness of sheets, 11-16 in.; working pressure, 200 lbs.; fuel, coal; staying T crown bar.
Fire Box—Material, steel; length, 108 ins.; width, 66 ins.; depth, front, 68 ins.; depth, back, 64 ins.
Water Space—Front, 5 ins.; sides, 5 ins.; back, 5 ins.
Tubes—Material, steel; wire gauge, 0.125 in. M. M.; Number, 245; diameter, 2¼ ins.; length, 20 ft.
Heating Surface—Fire box, 179 sq. ft.; tubes, 2,874 sq. ft.; total, 3,053 sq. ft.; grate area, 49.5 sq. ft.
Driving wheels—Diameter, outside, 77 ins.; diameter, inside, 70 ins.; journals, front, 11 x 10 ins.; journals, back, 9 x 12 ins.
Engine Truck Wheels—Front, diameter, 33½ ins.; journals, 6 x 10 ins.; back, diameter, 45 ins.; journals, 8 x 12 ins.
Wheel Base—Driving, 13 ft. 4 ins.; rigid, 13 ft. 4 ins.; total engine, 33 ft. 7ins.; total engine and tender, 64 ft. 1¼ ins.
Weight—On driving wheels, est., 143,600 lbs.; on truck, front, est., 43,400 lbs.; on truck, back, est., 44,300 lbs.; total engine, est., 231,300 lbs.; total engine and tender, est., 393,000 lbs.
Tender—Wheels, No. 8; diameter, 33½ ins.; journals, 5½ x 10 ins.; tank capacity, 9,000 gals. water; tank capacity, 10 tons coal; service, passenger.



"PACIFIC" ENGINE FOR OREGON RAILROAD AND NAVIGATION COMPANY.
J. F. Graham, Superintendent Motive Power. Baldwin Locomotive Works, Builders.

The New York Central & Hudson River Railroad Company has ordered 150 new passenger cars which are to be built wholly of steel. It is announced that the officers of the company are of the opinion that the construction of passenger coaches has been completely revolutionized, and that in time steel will entirely replace wood.

A paragraph has been circulating in the press of two continents that a certain locomotive belonging to the London & Northwestern Railway had run 2,000,000 miles in train service since 1882. If that engine had been on an American trunk line she would probably have been scrapped years ago with a smaller mileage, but work accomplished standing to her credit.

How to Make Good Foremen.

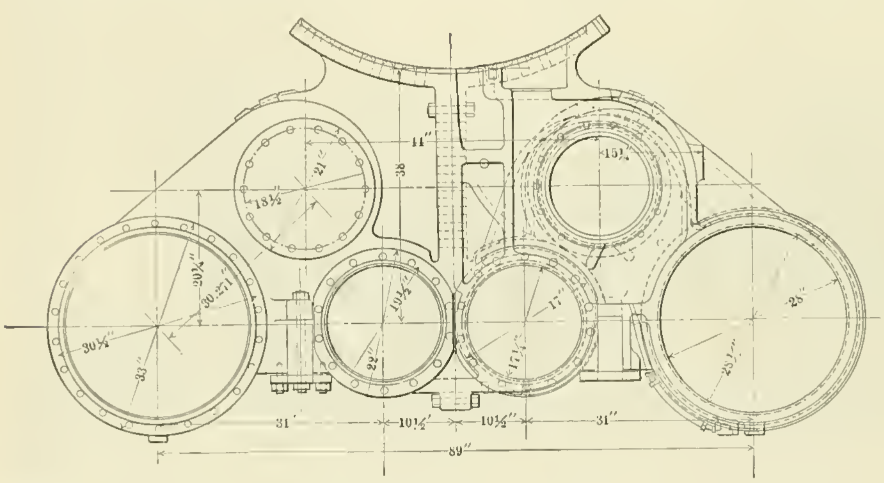
BY H. H. VREELAND.*

The latter half of the last century was an epoch of vast economic changes. The wonderful development and adaptation of steam and electricity to transportation and manufacture have revolutionized industry and made it impossible to carry on any business with success except upon a large scale and with large capital. There is a gulf between the independent employer of the middle ages and even of the middle half of the last century—the master workman with his two or three apprentices, and the head of a great establishment like the Krupp Works, at Essen, in Germany, with its 45,000 employees all depending on a single family for their livelihood, and whose welfare is inseparably bound up with the good or ill fortunes of the master minds directing that vast enterprise—the largest single enterprise in the hands of a single family, I believe, in the world. Who can tell what similarity exists between the conditions under which labor was performed in connection with the stage coach of fifty, sixty and seventy years ago, with its relays of horses, and the service on our railroads. Where the stage line at most permitted one man to employ perhaps a hundred others, the great transcontinental railroad system, with its connections, comprising a network of 10,000 miles, and perhaps, in one instance, of over 30,000 miles; with its

* President Metropolitan Street Railway Company, New York.

army of tens of thousands of employees, forming the most highly organized industry in the world, employing and requiring, for its proper operation, every phase of intellectual and physical energy, and comprising in its staff, aside from the purely executive department charged with the responsibility of general and financial management, every class of scientific, professional and technical knowledge, and having on its rolls civil, electrical, mechanical and refrigerating engineers, architects, doctors, lawyers, chemists and even political economists, for the purpose of enabling the executive management to ascertain the factors which will determine the demand for and the probability of transportation and distribution of the products created by the factories, the mines and the farms situated along their railroads; in fact, employing experts of all kinds, whose services are either constantly in requisition or occasionally necessary, for the proper administration of its affairs.

In the days of the stage coach, small factory or shop, the owner and his men were in close and constant contact; they were virtually associates in business, and their relations depended on their mutual temperament and were usually exceedingly cordial.



SECTION SHOWING CYLINDER ARRANGEMENT OF OREGON RAILROAD ENGINE.

In the complex system of industry which modern conditions of production and distribution have created and fostered—and which there is no possibility of changing, despite all the dreams of the socialist and the communist; for, time but more highly organizes every industry and necessitates the employment of larger sums of capital—the directing heads rarely come into direct contact with the men to carry out the details, by physical labor, necessary for the development of the plans conceived in the office.

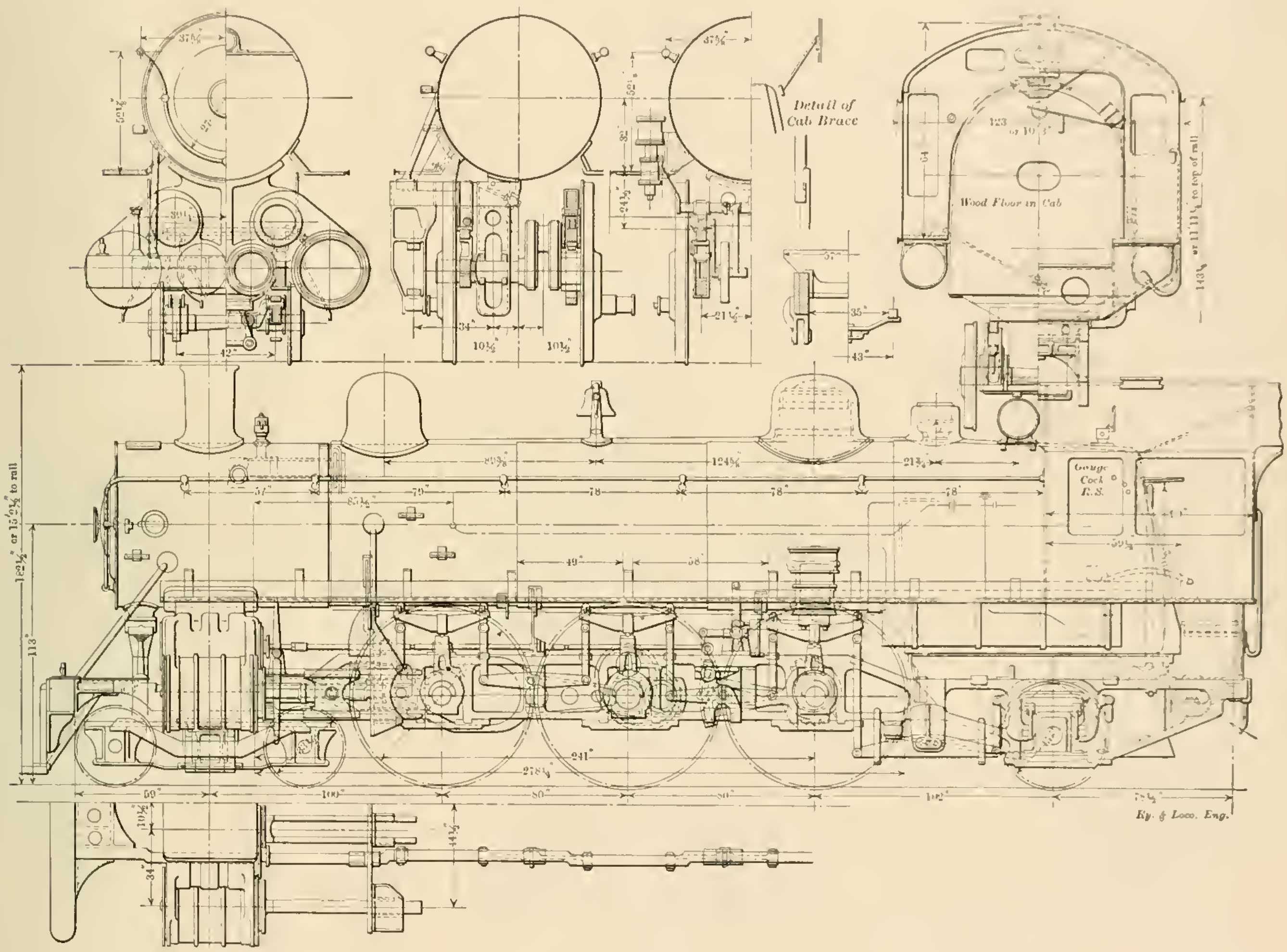
The growth of corporations with their vast combinations of capital, absolutely essential for the conduct of large enterprises, because no one man's resources, nor the resources of any dozen men, vast as individual fortunes have grown, would be sufficient for the equipment and operation of an enterprise as great as that of the United States Steel Corporation, or the Pennsylvania Railroad System, or the Union Pacific System, employing the energies and absorbing the lives of over 100,000 men—has changed not merely the factors of production and distribution, but the relations between men themselves, and injected into modern life a problem, namely, the proper adjustment of the relations between labor and capital—far more difficult of solution than any which has confronted society in past ages.

Capitalists, whether willingly or unwillingly, are being brought face to face with this problem. While some would ignore it and claim they can do what they please with their own, and that labor is but a commodity to be purchased in the market as any other at what is its market price, the vast majority of the larger employers, to my personal knowledge, and those concerned in the financial management of the great corporate systems, recognize that supply and demand are not the only factors in the determination of the amount of wages they shall pay. They recognize that the American workman, whether native born or such by adoption, living in this land with a rich heritage, the discovery and opening of which was God's greatest gift of charity to man (as our great Emerson said), is entitled to and will be content with nothing less than a fair and just share of the returns which his labor produces; that he must be treated as a social being having the right to rear a family, educate them in accordance with American traditions, and fit them to enjoy the advantages which he sees so abundantly distributed around them. He demands that the American workman shall have wages sufficient for this purpose, and also that he shall have sufficient leisure to educate and inform himself on the questions which arise in his country, in the administration of whose affairs as a citizen he has such a vital interest. Having established a system of popular education on the theory that every man should have his mind cultivated to the utmost compatible with his circumstances in life, and having conferred the ballot and given universal suffrage on the theory that every American should have a voice in the government of his country—it is idle to deny to him a sufficient wage to enable him to take advantage of the opportunities thus opened to his mental vision provided he lives frugally and soberly. But this theory of the wage does not involve a concession to any of the doctrines of socialism as to equality of distribution, or equality of opportunity or equality of any kind except freedom to contract and equality before the law. Men's natures, their talents, their environment, their inclinations and their industry all differ, and have differed from the earliest traditions of the race. Therefore, we need not make any concession that all men should be equal, because, they would be neither capable of taking advantage of equal opportunities, nor would they, if they were placed by force in absolutely equal positions, all be willing to exert themselves sufficiently to remain on the same plane. The differences thus inherent in the very nature of men constitute the main incentive for the exercise of all our energies—some will rule, while others must obey. But the good order of society and the development of our civilization absolutely require that there shall be a just coordination between individual freedom and the collective rights of the community or just and orderly government, whether in the State, or in the mine, or in the factory, or in the worshop, or in the office, or in the railroad system.

The question of wages is not the only dominating factor in the solution of the labor question. There is another factor which I deem of almost equal if not greater importance, and that is, the relations between the directing mind or immediate superior of the employees and the employees.

We want no labor controversies if they can be avoided, and in this, as in all other cases, an ounce of prevention is worth a pound of cure. As long as human nature remains unchanged—and, in its essential qualities it has undergone but very little variance, as history teaches—there always will be differences between employer and employee, and these will be sometimes too acute for immediate amicable settlement, and, during this period of heated controversy, strikes and lockouts may occur. But we can minimize these differences instead of accentuating them, and we may foster and engender relations of good will so close and intimate between employer and employee that when unavoidable differences do part them for a time, their disputes may be adjusted with as little acrimony and delay as possible. In inspiring and creating this good will no single factor is of such consequence as the careful and judicious selection of those who are put over and have the immediate direction of the employees, from the most subordinate grade of authority to the highest. For, but little reflection will disclose that nearly every crime arises from a wound to someone's vanity, and that once men are insulted or offended it is virtually impossible to bring them qualifications for handling men?" After his appointment the most careful scrutiny is made of the results of the work under his charge in dollars and cents; little or no consideration is given to the equally important question of methods of discipline and consideration for those who are under his charge.

We gain our experience from association and intimate relations with men. A man trained under an incompetent foreman, incompetent so far as relates to his ability to handle men, knows no other course and uses the same methods parties. A well-equipped man at the head of a labor department has ample time not only to study the system of workings of the organization as a whole, but to study the traits and characteristics not only of foremen, but of individual employees. He is in a position to detect any irregularities in the system, as well as to discover what the feeling of employees is; what complaints are in the minds of subordinate employees if not openly expressed; to study causes for same; to suggest remedies, and in cases where matters are brought to an issue



DETAILS OF OREGON RAILROAD AND NAVIGATION COMPANY'S ENGINE.

to reason, no matter how just our claims upon their obedience may be; but if we have their respect and good will causes of contention are readily compromised.

The selection of properly trained men for promotion to the position of foreman in charge of employees is, or should be, one of the most important factors in organizations. Every consideration is given to the qualifications of a man for the position of foreman in the interest of the corporation when the closest scrutiny is made of his ability to so organize forces as to secure the greatest output. Very seldom is consideration given to the question, "What are his when he gets the opportunity. In a large organization how can this be known? Either by close supervision on the part of the general manager or, what is better, the appointment of a well equipped man to the position of head of labor department. In the present day of large corporate enterprises, employing thousands of men, many important questions come up every day to tax the time and physical strength of the general manager and do not admit of his giving the necessary time for consideration of the question at issue, and what he does is done in a perfunctory way and his decisions can only be made on reports of interested with the management, to be able to advise with a full understanding of all details from both the corporate side and the side of the employees; also to suggest where improvements can be made in the interest of improved sanitary or working conditions to the benefit of both the employer and the employee. In a word, to care for the welfare department of the organization.

I have made a very careful study of this subject and have followed the principles I have enunciated in connection with the working of the property of which I have charge. We employ a very large number of men and have to do with all conditions that appertain to manufacturing and industrial establishments as well as operating a railroad, as we have large shops in which are employed men of different trades. We have no head of a labor department of the character I have described, but we have an organized bureau for the appointment of men in which every effort is made to secure a uniformity of character and experience. As I desired to make a personal study of the value of such work to the organization I have taken direct charge of what might be termed the labor department and thus have been able to put into effect my ideas and to follow their workings and see the result. One of the features of which was the organizing of a method or system of reports in which the capacity and qualifications for handling of men and proper methods of discipline is shown by a system of records which checks one department or branch of the service against another, not only in like work, but also total number of employees under one department head against that of another. I started with the theory that where all employees were appointed through references and qualifications examined into by one man and these employees distributed through the organization by a system of requisitions on the appointment bureau, secured a uniform standard of employees throughout the system subject to the orders of subordinate department heads and under them the foremen. I believed that there was no reason why foremen "A" having five hundred men subject to his orders under one well defined system or management with one set of rules and regulations, should find it necessary to suspend or discharge more men in a month, or covering any period of time, than foreman "B" with a like number of men working under like conditions. This is worked out on a table of percentages so that at a glance the manager can tell what each foreman is doing in this direction and gives his just as safe a method for calling attention to defects in this line as easily as a study of output and financial results of any particular branch or department of the organization.

This system incites heads of departments and all subordinate managers to greater consideration for their men, and at the same time fosters the desire in them to learn the art of managing men; and also enables the company to develop a system of civil service by which, as their fitness for greater responsibilities is shown on the part of foremen, they may become superintendents, heads of divisions, and subsequently departmental managers; for, it is indisputable that, as the modern industrial system requires the co-operation of large bodies of men in common undertakings, if it is to be operated without unnecessary friction, hope of advancement must be held out to aspiring, ambitious and capable minds as a reward for their fidelity and devotion.

The American workman is the most intelligent of all men of his class, and if his hearty co-operation is given to the development of any enterprise it is certain of success. Having his hearty sympathy and his good will, the settlement of all differences with him can readily be reached. It is unnecessary to call your attention to instances where the cordial relations between employers and employees have recently tided over many an acute situation in the labor field, because, many such instances must be fresh in the minds of all; but I cannot refrain from referring to the cordial relations which have existed now for some years between the bituminous coal mining operators and their men, and the organizations of railroad employees and the heads of the great railway systems, in which in very recent years no serious disturbances have occurred and none seems to be immediately threatened. No one can measure or estimate the vast amount of financial loss to both employers and men, without reference to the great hardships inflicted upon the men and their families, inflicted by the great strikes and lockouts; and any system which will foster feelings of good will and friendship between employer and employee and minimize these losses and hardships is to be welcomed, and is worthy of the earnest effort and thought of every man who lives his fellow men and is desirous to seeing this great republic progress and maintain that position of pre-eminence in the civilized world as the Home of Freedom and the Land of Plenty and Prosperity which it to-day holds, and, we trust, will always maintain.

Oiling Round.

In the good old days before the expressions oil and fuel economy came into use, certain locomotive engineers never failed to drop oil upon all the bearings within easy reach every time the engine stopped. It might be that three or four extra stops were made in the course of a run, but down stepped the engineer at every place and kept the oil can in operation. As a rule the oil was wasted, but oiling round gave the engineer pleasure that is sternly withheld in these days when every drop of lubricant has to be accounted for.

These thoughts naturally arose on reading a newspaper paragraph to the effect that the locomotive engineers at the Boston & Maine roundhouse have received the monthly interrogatory sheet inquiring as to the amount of work accomplished during the past month on an expenditure of one pint of oil. The expectation is held by the master mechanic that each engineer will use his utmost endeavor to make a better record than 100 miles to the pint of valve oil, 50 miles to the pint of engine oil, and 40 miles to the pint of all kinds of oil used on the road when out with trains.

A Troublesome Cow.

Here is one of the most persistent railway anecdotes of our acquaintance. It comes out fresh and new every spring, generally from an Ohio local paper. This time we clip it from an English magazine noted for ancient, witty lore:

A man was once traveling by rail in the Transvaal when suddenly the train stopped. Putting his head out of the window, he asked the guard what the cause of the delay was.

"Only a cow on the line," answered the guard.

The train soon started again on its journey, but, after a few hours, again came to a stop.

The same passenger, again putting his head out of the window, asked the guard the reason of the stoppage.

"Another cow on the line, guard?"

"No, sir," replied the guard, solemnly; "it's the same old cow."

Railroad Smugglers.

The laws prohibiting the transportation of alcoholic liquors into the Indian Territory give peculiar temptation to certain railroad workmen. The latest case of ingenious evasion of the laws was that of a teamster working on a railroad grade, who devised the plan. He had two very large horse collars made water-tight. He would make regular trips to Texas, and every time he would return the laborers would get drunk. After watching him for a long time the officer discovered that he would take the extra horse collars with him and bring them back full of whisky. Each collar would hold about two gallons of liquor. The man is under arrest.

Steel Cars for Street Railways.

Following the lead of the Interborough Rapid Transit Company, the New York City Railway is experimenting with steel cars, which may replace the wooden ones now in use. One fitted for daily use and built by the Pressed Steel Car Company has been making regular trips for some time, and is, of course, giving satisfactory service. Steel is eminently fitted for street railway car construction for it combines lightness with strength and is certain to be more durable than wood.

Steam railroad companies were very backward in trying steel cars, but the tendency now moves very strongly in that direction and the time seems approaching when wooden rolling equipment will be a thing of the past.

General Correspondence.

Trains Order Cabinet.

Editor:

I herewith send you a copy of a patent I have recently taken out, which I think you will readily understand. I have had one of these cabinets installed in one of our offices on the road for a month, and it meets the high approval of the officials and operators that have to work them. In my service with the Southern Railway Company I have been in one head-on collision and observed several others, which my invention is supposed to prevent. I intend for my device to cause the operator to handle his semaphore signals properly, and before he can pull the signal to bring before him any orders that he may have to deliver. I also have midway of each lever a message hook for plain messages. I have made some minor changes from the present drawing, but not worth while to go into detail about. I will also mention some colored features that don't show in the drawing. For instance, the clips are all painted black and behind the clip on the door will be painted red with a white dot one inch in diameter. I use the coloring to attract the vision, as, you understand, the clips on the doors are merely to be used as files for train orders to be delivered to previous trains.

I have been working and studying this device for the past eighteen months. I have changed and rechanged every part from my first idea. I don't think a simpler device can be made to serve the purpose I intend it for—that is, to keep constantly in the operator's mind the position of the signal and to bring before his observation any order he may have for a train before he can pull the signal. I also have a means of locking the lever with a peg put in a hole in lever. If so desired, above each door will be stenciled, and on each clip, North, South, East or West, odd or even numbers, as the case may be; you can't confuse the clips, as they are not interchangeable.

This is my view about my invention: It is a common thing throughout the country for operators to let trains get by them or fail to deliver an order. As you know very well, handling trains and train orders is the most responsible part of railroading, and there is a double check on everything but an operator handling his signal right and delivering train orders. The engineer has the fireman, conductor and both brakemen to check him; in transmitting orders there is the dispatcher and one or more operators to check each other, but after he receives his order it is up to the operator alone to do the rest, and as there never will be any one personally to check him, my device will come nearer checking him than anything I know of.

B. M. McCleskey.

Louisville, Ky.

The claims made by Mr. McCleskey for his patent are:

1. A train-order cabinet, having a hinged door, plates, means for attaching papers loosely to said plates, and means for attaching said plates removably to the inner side of said door, and levers within the cabinet adapted to hold the ends of semaphore cords, and which, when horizontal, extend beyond the doorway of the cabinet, substantially as described.

2. A train-order cabinet having two hinged doors, plates, means for attaching papers to the plates, and means for attaching the plates to the inner sides of said doors, and levers within the cabinets adapted to hold the ends of semaphore cords, and which, when horizontal, extend beyond the doorway of the cabinet, substantially as described.

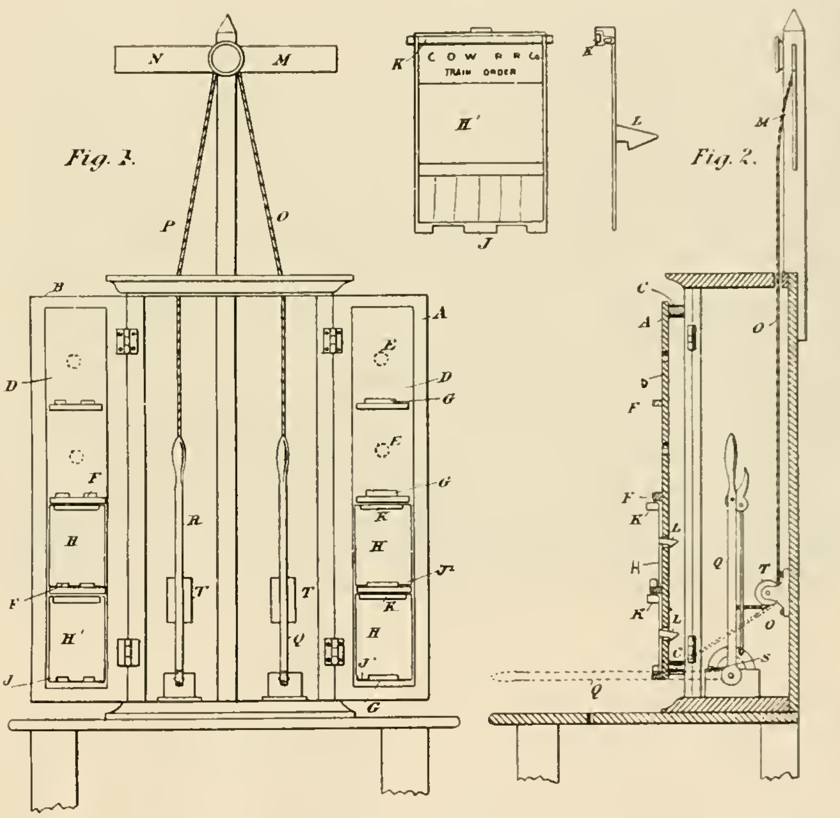
3. A train-order cabinet, having a hinged door, holes in the inner side thereof, plates having pins fitting in said holes and bearing clamps for papers, and levers within said cabinet, which, when horizontal, extend beyond the doorway of the cabinet, substantially as described.

4. In train-order cabinets, the combination of a hinged door, adapted to hold despatches, and levers within said cabinet, which, when horizontal, extent beyond the doorway, substantially as described.

5. In train-order cabinets, the combination of two hinged doors, each adapted to hold despatches regarding trains in only one direction, and two levers within the cabinet, which, when horizontal, extend beyond the doorway of the cabinet, substantially as described.

6. A train-order cabinet, having two hinged doors, plates, each of which is adapted to be attached to the inner side of only one of the doors, paper-clasps on said plates, and levers within said cabinet, which, when extended horizontally, project beyond the doorway of the cabinet, substantially as described.

[We think that the general introduction of this cabinet would be a good



TRAIN-ORDER CABINET.

check on the telegraph operator, and, therefore, it would prevent accidents. That ought to recommend it to the favorable attention of railroad managers. —Ed.]

Starting Power of Locomotive and Electric Motor.

As a reader of your valuable and interesting journal, it would please me very much if you would kindly answer the following questions in regard to the recent speed trials on the New York Central Railroad, of trains driven by steam and electricity, respectively.

The trials showed that the acceleration of speed in the steam locomotive was much slower than in the one driven by electricity.

Why cannot the steam locomotive attain its maximum speed more quickly?

Is the steam unable to enter the cylinders fast enough, and are the port holes too small perhaps to allow it to enter in sufficient volume?

At these trials it was also noticed that the tractive effort of the steam locomotive sank very rapidly with only a comparatively slight increase of speed.

Does the back pressure in the cylinders perhaps retard the forward motion of the engine, and does the motion of the reciprocating parts of the steam engine act like a brake when the locomotive is running at high speed?

Now, that electricians predict the substitution of electricity for steam on all railroads in the near future, the question naturally arises, whether or not a steam locomotive could be constructed that would be able to compete successfully with its electric rival.

Fred F. Kirpal.

Brooklyn, N. Y.

[A.—Owing to various circumstances, it is practicable to concentrate greater starting power in an electric motor than in a steam locomotive. We do not believe that the steam locomotive is susceptible of improvement that would greatly increase its starting power.—Ed.]

Broken Reach Rod No Brake.

Editor:

I note that in reply to a question in the issue for June, asking what to do to stop an engine descending a mountain grade without brake and with a broken reach rod, you say that if not possible to fish up the eccentric, or tighten one side of stuffing box gland, it would be impossible to do anything to stop. Allow me to suggest that a better way than either one mentioned would be for both engineer and fireman to go out on running board, one man to hold and steady the other, while he endeavored to break connections between valve rod and stem, drive up the key on same if possible. If not, a few well directed blows should break the joint. This done, the valve would probably stop on one end of chest. If not, you could drive it over by striking on end of stem. When you have valve in position to cover port on one end, go back and open throttle. When open long enough to fill cylinder with full pressure, shut off. Now the compression of the confined steam between piston and cylinder head would hold her down. When speed was reduced enough open cylinder cock and release steam. Repeat when necessary, to control speed or stop.

When foot of grade was reached you could stop and connect valve rod and stem if same was not bent or broken, or block valve on posts on disabled side and go in on one side.

As you say, this is in one sense a catch question, and there is not probably one chance in thousands of its ever occurring, but if it should, and on a long grade, this would be, I think, the best way to do. A. C. E.

Old-Time Railroad Reminiscences.

by J. S. Kidder.

Editor:

It is generally understood that the proper thing for one to do is to mind his own business, and while as a very general proposition this is unquestionably the proper practice to pursue in my experience as a locomotive engineer, on divers occasions, it has been strongly impressed upon me that there are times when by minding the other fellow's business serious trouble was averted in the way of what promised very disastrous wrecks in which my personal safety would have been jeopardized as well.

Again, I have little faith in the oft-repeated assertion that the engineer has constantly in mind the safety of the lives and property under his charge, but rather that he is looking after his own personal safety, and so long as he uses every possible precaution in so doing it quite naturally follows that he is protecting everything connected with his train.

To be sure the newspapers frequently laud the brave engineer who sticks to his post when unavoidable accident is impending, gallantly losing his life in an endeavor to protect the passengers and all that sort of thing, but that isn't what the engineer does at all. When he has utilized all the appliances at hand to stop his train his presence then ceases as a safety factor and the "hero" who stays with his engine either fails to have the opportunity or time to look out for himself or in the excitement of the moment loses control of his thinking faculties.

My acquaintance among engineers has been quite an extended one, but I have never met any of these heroic individuals who would not much prefer to be a live jumper rather than remain on his engine and be picked up from among the debris the remnant of an alleged dead hero.

I am led to these conclusions from a couple of incidents, when I took it upon myself to mind the other fellow's business, the results of which were so satisfactory that they no doubt contributed very largely to my now being on this mundane sphere and ability to contribute to Railway and Locomotive Engineering.

On the Iowa division of the C., B. & Q. R. R. we were going west one morning about three o'clock, an hour when the engineer usually takes advantage of a side track delay to indulge in an impromptu nap. Upon reaching Rome we received orders to meet three extras east at Glendale and to give them a clear main track.

Barnum's circus had exhibited at Fairfield the day before and we had been advised that the three sections were composed of this circus aggregation. Arriving at Glendale we headed into the siding, pulled up to the west switch and upon stopping I went to the front of the engine to cover the headlight. As I did so I noticed the head brakeman go to the main track switch which, by the way, was unprovided with a switch lamp, open it, then picking up his lantern saunter off down the track to the station, perhaps a dozen car lengths, to the rear of the engine. As he disappeared in the building I went to the open switch and seated myself, waiting for further developments, as I was quite interested to see whether this brakeman, quite long in the service, would discover his error and take measures to correct it. Some twenty minutes passed when the station whistle of the first extra sounded as the engine rounded the curve a half mile or so west of the depot, and a moment later the headlight illumined the tangent which extended east and beyond the station.

The engine had hardly entered the straight track when from the station platform a "highball" signal was given to which the engineer responded, and immediately following the rockets, began ascending from the smokestack in profusion, I, meantime, closing the switch, and a minute later the train thundered past the switch as a speed of thirty or more miles per hour. With liberal spacing the other extras came and went, and when the last one cleared we pulled out, the brakeman again opened the switch and as the engine passed him he swung gracefully onto the tender step then into the gangway where he stood watching for a signal ahead from the rear brakeman, after closing the switch.

Preliminaries being concluded, I opened the throttle as the brakeman took his accustomed place on the front end of the fireman's seat box, then turning to him I said, "what did you do after we stopped in the siding," and to which he replied, after looking at me several moments in surprise, "blankety blank I opened that switch on the main line."

Did that brakeman get reported and suspended? Not by any means, for the object lesson was of more value to him and the railroad company than a half dozen suspensions or a whole row of demerit marks.

That he possessed the attributes essential to the making of a good railroad man is evidenced from his long and successful career as conductor up to the present time and on the same road that he inadvertently flipped the main line switch.

Your readers may imagine from what was said in the introduction of this article that I am scheduled to say something about having had an opportunity to be a "hero," but while the opportunity for such would have been most promising had I not used what might perhaps be called a little good judgment, as it was, the chance for heroism failed to materialize.

I was westbound with the Kansas City Express, No. 5, a night run leaving Burlington some thirty-five minutes behind time. This was an express (?) train stopping at all stations, but to maintain the time card demands required a pretty lively gait between the frequent stopping points. At New London, 19 miles from Burlington, was the regular meeting point with freight train No. 16, which usually runs in two or three sections, while at Mt. Pleasant, nine miles beyond, we were scheduled to meet No. 4, an eastbound train having the right of road over us. Arriving at New London we found that No. 16 had not reached that point, and as we could make no further progress against the opposing passenger train, we took the passing track, and very shortly after that train arrived. We were still considerably late as we pulled out from New London and I anticipated a quick run to Mt. Pleasant, the track being especially favorable for fast time. A half mile west of the station the crest of a hill was passed, then came a down grade a mile or more in length from the foot of which to Mt. Pleasant was straight track across the prairie, having a gradual decline with three unimportant dips. Descending the grade, the 245 was soon putting in her best turns and a few minutes later was nearing "lunatic switch." This switch was located in the neighborhood of a mile east of Mt. Pleasant station, its name being derived from an insane asylum hard by, the siding being used as a supply track for the institution.

This was my usual landmark for shutting off steam and whistling for the station, but as I did this I observed the absence of a switchlight in the yard ahead and from my familiarity with the location of these lights it was noticed that the one at the east end of the south-passing track was not lighted, in which track stood the freight train we should have met at New London.

My first impulse was that the high wind then prevailing was responsible for the absence of the light; the next, that freight business at the time was exceedingly heavy, which involved the employment of many green head brakemen, and instantly following these reflections I applied the brakes. Soon after the headlight brought to view the dash on the switch target, which denoted that the switch was wrong, upon which I reversed, the steam cylinders were used for driver brakes in those days, and started a liberal supply of sand on the rails.

We made a very creditable stop, the engine heading into the side track, stopping with a space of about 20 feet between the pilot of John Otton's engine, the 44, and the 245.

As it was near this passing track switch that I usually began applying the brakes to make the station stop, it leaves it somewhat problematical had I closely approached the switch before brake application where I would have been shortly after discovering the switch was open, though it is reasonably safe to affirm that the papers next morning would have had no engineer hero to write up in connection with the disaster which would inevitably have taken place.

Subsequent events proved that both of my surmises were correct, for an investigation developed the fact that the green brakeman was responsible for the trap which had been set for us. The sixteens being late were compelled to take the side track for No. 4 to pass and being trains of an inferior class could not proceed unt'' our arrival.

This being the case, the engine and train men had taken advantage of the delay to visit the lunch room across the main track from the station and regale themselves with Wilder's hot, choice viands.

Following the departure of No. 4, the brakeman, whose knowledge of time card rules was extremely limited, preliminary instruction and examination of new employees not being in vogue then as now, had followed the train to the switch, the light of which had been extinguished by the wind, opened it, then after waiting a time and seeing no signs that his train was to follow the departed one had returned to the lunch room, thoughtlessly neglecting to close the switch.

Now as to the moral to be drawn from these reminiscences. The writer believes that when the other fellow's business does not concern him he should in no wise mix up in it, but, as in the operation of railroad trains, a little neglect or carelessness on the part of another employee may jeopardize one's safety or the company's property.

AN EXCURSION TRAIN DRAWN BY FOUR FELL ENGINES ON THE RIMUTAKA INCLINE. GRADE, 1 IN 15; WEIGHT OF TRAIN, 174 TONS; LENGTH OF TRAIN, 648 FEET.

—From Cassier's Magazine.

for which he is responsible, it would then seem to become a duty and quite in line with propriety to take the safe side, particularly in the case of an uncertainty, and mind the other fellow's business.

Roundhouse Repairman.

Editor:

We hear a great deal said about roundhouse repairs nowadays, and of the proper facilities for carrying them out; but in the agitation favoring perfected machinery for roundhouse work a very important factor is generally left out, and that is the man behind the machine, also the person supervising that man. Good facilities are all right, but a bright, wideawake machinist is of greater importance even than tools. The efficient men look ahead and anticipate possible emergencies that pop up unexpectedly. The look-ahead man will keep on hand all the parts most likely to be needed for running repairs. Eccentric straps can be kept in stock ready for boring, crank pins can be kept ready for fitting, and duplicates of every piece likely to break ought to be kept ready to apply with the least possible fitting. Yet how often do we find engines kept in for days, waiting for parts to be sent from headquarters that ought always to be on hand ready.

I have seen a great deal of fool management of roundhouses in my time that was very costly to the company paying for the wrong man. This kind of thing generally happens through favoritism in selection of the foreman. Many incompetents have been pushed into that position merely because they were friends of the Old Man, and no position could be chosen where a favorite or a relative could do more all-round harm. MACHINIST.

San Francisco, Cal.

Improving Railroad Methods.

The Long Island Railroad, one of the proprietary lines of the Pennsylvania System, is becoming a leader in advanced methods of railroad operating.

In connection with the telephone service the railroad will introduce a novel method of road inspection by emergency crews of four men, who will constantly patrol the road in gasoline motor cars running on the tracks. When the electrical road opens there will be two of these crews, one stationed at Long Island City and one at Woodhaven Junction. When out on the road the crews will keep in touch with headquarters by telephone, and can always be summoned for emergency work. In particular they will look after the transmission lines.

The automobiles can bowl along at thirty miles an hour. They weigh 750 lbs., and will carry complete kits of necessary tools.

Pneumatic Hammer.

When workmen are of an ingenious turn and are anxious to facilitate their output, there will always be found engineering men producing the sort of home-made appliances for which American railroad shops are noted. The pneumatic hammer illustrated in the annexed engraving is a good illustration of this tendency, and was got out by W. J. Shea, master blacksmith of the Illinois Central Railroad, at McComb, Miss.

The hammer was made from an 8-in. W. A. B. cylinder, cast iron block for the anvil, and the upright frame is an old mortising machine which had been scrapped from the car shops. The hammer is operated by a foot treadle connected with the three-way valve on top of the cylinder by a rod which leaves both hands of the operator free to handle his work, as shown in the engraving. The hammer takes air on top of piston

HOME-MADE PNEUMATIC HAMMER.

only, and is pushed up again by coil spring, same as used in W. A. B. cylinders. The piston is three inches in diameter and has a steel die keyed on for the striking part. The frame could be made of old channel irons or even a wooden post would do.

In order to acommodate the new and heavier locomotives to be used, all the Erie Railroad roundhouses are to be enlarged so as to give a uniform depth to the "stalls" of ninety-five feet, an average increase in depth of about ten feet. The new turntables to be installed at each roundhouse will be eighty feet in length, this enlargement being made necessary also by the increased size of the locomotives. New roundhouses of ten stalls each are to be built at Hammond, Ind., and Marion, Ohio, one of fifteen stalls at Port Jervis, one with fourteen stalls at Kent, Ohio, and one with six stalls at Bradford, Pa.

The American Locomotive Company have made arrangements to go into the manufacture of the Berliet automobile on an extensive scale. Part of the locomotive works at Providence, R. I., will be devoted to the automobile business, and some extensions will be made to provide the required facilities. The company are proposing at first building two sizes of automobiles, one 25 h.p., the other 40 h.p., but they expect to go largely into the manufacture of heavy motors for truck purposes. The Berliet automobile is well-known on the continent of Europe, and has an excellent reputation for durability and reliability. We understand that automobiles for light steam railroad service will also be built as demand for such motors arises.

The Baltimore & Ohio Railroad has established a test bureau, where all work of this character will be concentrated in the future. Mr. J. R. Onderdonk has been appointed engineer of tests, in charge of the bureau, with headquarters at Baltimore, reporting direct to the general manager. To this bureau will be submitted for analysis, inspection and test all equipment, materials and appliances bought under specification, and all experiments of equipment, material and appliances will be made under the direction of the engineer of tests.

A college professor, fond of statistics, has been counting up the number of college men whose names are recorded in American biographical cyclopedias, and finds that the proportion is 57 per cent. Hence he reasons that the college course is a certain means of gaining success in business.

The American Steel Foundries has received an order from the Atlantic Coast Line for 1,000 cast steel body bolsters for 30-ton box cars to be built at the shops of the South Atlantic Car & Manufacturing Company, at Waycross, Ga., and 2,000 cast steel body bolsters for the same class and capacity cars to be built by the Western Steel Car & Foundry Company, at their Anniston plant.

S. S. Blevins, a machinist in the Santa Fe shops, in Ottawa, Kan., has invented a rotary engine which is said by engineers to be exceptional in its simplicity. The new engine has been successfully operated in the Santa Fe shops, and as a further test is now used to operate part of the machinery in the basement of the Portsmouth building in Kansas City, Kan.

Compound 2-8-0 for the Soo Line.

The Minneapolis, St. Paul & Sault Ste. Marie Railway, commonly called the Soo Line, has recently purchased some heavy 2-8-0 compounds from the American Locomotive Company. Although the engines were built at Schenectady shops of the locomotive company, the design is to be attributed to Mr. T. A. Foque, mechanical superintendent of the road.

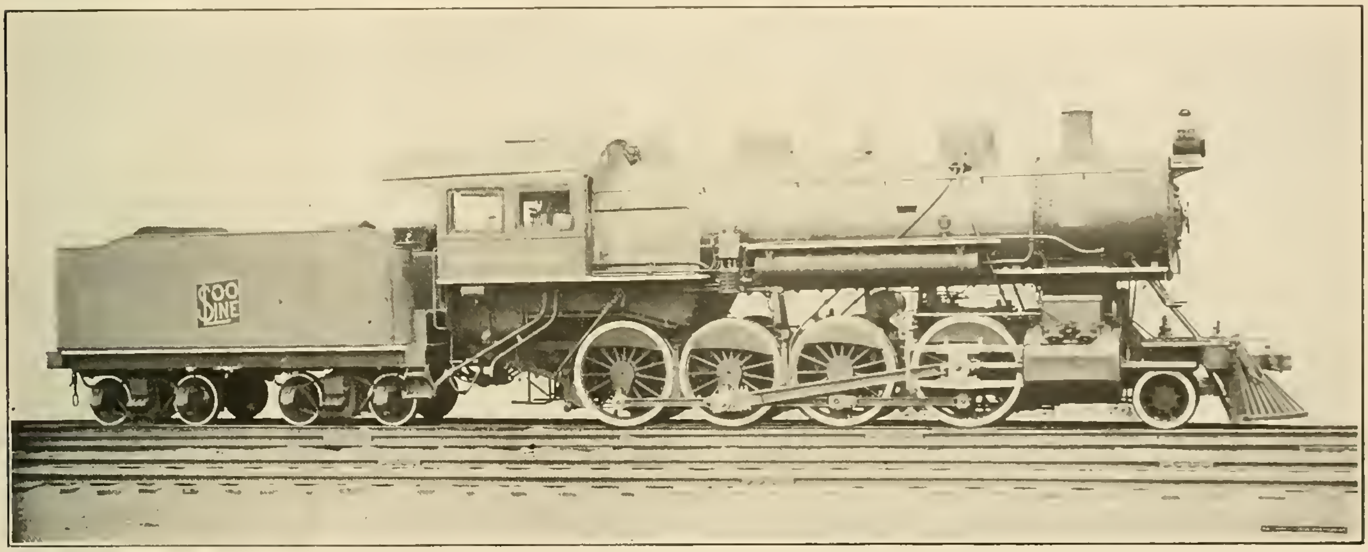
The engines are equipped with the Cole superheater, which is placed in the smoke box. The cylinders are 23 and 35 x 34 ins. The driving wheels are 63 ins. in diameter and all are flanged. The tractive power of this engine is about 37,300 lbs., and the factor of adhesion is 4.51. In these engines the high pressure cylinder has a piston valve, and the low pressure has an ordinary balanced slide valve, as shown in our illustration. The valves are operated by indirect motion. The connecting rod is of the usual I-beam section, and is 12 ft. 4 ins. long. Its length naturally tends to reduce the effect of its angularity. It will be noticed in the illustration that the reach rod is made of wrought iron pipe with suitable fork ends.

The boiler is the usual extension wagon top type. It is 66 ins. inside diameter at the front end, and the taper course, by a long easy slope, brings the waist measure of the third course up to 76 ins. outside diameter. The fire box extends beyond the frames, and has a grate area of 46.8 sq. ft. The total heating surface is 2,565½ sq. ft., of which the fire box sheets contribute 158 sq. ft. The steam pressure carried is 210 lbs. per sq. in. There are two sizes of tubes in this boiler, 40 in the upper center are 3½ ins. diameter, and these pour fire box heat into the superheater. The other tubes are 2 ins. in diameter.

The U-shaped tank is carried on 10 in. steel channel frames and the trucks are of the regular arch bar type, with elliptical springs. The tender can carry 6,000 gallons of water and 10 tons of coal.

The whole machine is symmetrical in design, and the lines are pleasing to the eye. Extension piston rods or tail rods have been used with closed casing over them, and lubrication has been provided for by leading a pipe from the sight feed lubricator. The heating surface in the Cole superheater is 261.4 sq. ft. A few of the leading dimensions are as follows:

Weight—On drivers, 172,000 lbs.; truck, 29,500 lbs.; total, 201,500 lbs.
Wheel Base—Driving, 17 ft.; total engine, 25 ft. 11 ins.; total engine and tender, 55 ft. 10½ ins.
Driving Journals, 9½ and 9x12 ins.
Engine Truck Journals, 6x10 ins.
Fire Box, length and width, 96⅛x70¼ ins.
Tubes—Number of and diameter, 224-2 ins., 40-3½ ins.; thickness, No. 11, No 8 gauge; length, all 15-9 ins.



HEAVY CONSOLIDATION ENGINE FOR THE SOO LINE.
T. A. Foque, Mechanical Superintendent. American Locomotive Company, Builders.

The President's Handshake to Engineer and Fireman.

When any person in or about New York is afflicted badly with mental dyspepsia his discontent very frequently finds expression in a letter to the *Sun*. Here is one of the latest emanations of that character:

"Can you tell me of the motive and reason why President Roosevelt, at the end of a railway journey walks forward to the locomotive, no matter how long the train, and shakes hands with the engineer and fireman? I have asked in vain for a satisfactory answer.

"As governor of New York it was not his habit, when using the railways in the State, as I am told, nor has any President before Roosevelt ever practiced such locomotive handshaking. Neither the Chief Justice of the Supreme Court nor the President of the Senate, nor the Speaker of the House does what President Roosevelt does at the close of a railway journey. The habit is novel, as I learn, among Federal officials, and peculiar to the President now in office. Why does he do it? He seems to have invented the innovation.

"One person of whom I inquired thought the President wished to express his gratification because of a safe transportation without having been required to purchase a ticket, but such thanks, it seems to me, would be more naturally sent to the president of the company. If the handshaking is proper in order to show gratitude for safety, then all passengers should press upon the locomotive cab at the journey's end.

"CAN YOU EXPLAIN?"

The editor of the *Sun* did not attempt to explain, but we will. The President likes to shake hands with engineers and firemen because he regards them as a very manly class doing responsible work faithfully, and, therefore, deserving of all recognition of travelers whose safety has been cared for by the men on the front of the train.

Orders have been received by the Westinghouse Air Brake Company for the equipments of friction draft gear for 150,000 cars on the Chicago & Alton Railroad, Baltimore & Ohio, Bessemer & Lake Erie, Chicago, Burlington & Quincy, Lake Shore & Michigan Southern, Mexico Central, Lehigh Valley, Pennsylvania Company, Philadelphia & Reading, West Side Belt, Duluth, Mesaba & Northern, Duluth & Iron Range, Northern Pacific, Butte, Anaconda & Pacific and Missouri Pacific.

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Trifling With a Dangerous Power.

The agitation going on among politicians in favor of the government exercising closer control over railroad operating and railroad rates, finds no response among the army of railroad employees who depend upon the prosperity of railroads for regularity of employment and certainty of monthly visits from the pay car. Railroad people are seldom active politicians and for a long time they endure with calm fortitude vague abuse of their employers and even of themselves, but when there is danger of real blows being struck the railroad men don their fighting armor and struggle manfully in defence of their rights, and of justice for their employers. Should danger arise of Congress passing laws detrimental to the just interests of railroad men the leaders will find a very big and very active voting population ready to throw dangerous ballots. The absence of political activity among railroad men deceives the politicians into the belief that opposition to railroad interests strikes only stockholders and high officials, but they will receive a rude awakening if they proceed to pass laws which will reduce the just earnings of railroads. Between those directly employed on railroads and the people in other occupations that depend upon railroads for support a big proportion of our population is dependent upon railroad prosperity for their own livelihood. You may steal a man's good name and he will not suffer directly; but take away his means of livelihood and you spread immediate disaster that raises an instant tumult of protest.

The railroads in this country are employing more persons than ever before in their history. According to statistics in the report of the Interstate Commerce Commission there were 594 railroad employees for every hundred miles of tracks last year, and there were 1,189,315 employees altogether.

In the year before there were only 1,071,169 railroad employees, and the average was only 548 for every hundred miles of line, so that independently of the increase in mileage the number of workers employed has increased 46 for each hundred miles of line.

Since these statistics were collected there has been a correspondingly large increase in the number of employees, if railroad statisticians are to be believed, so that the number of men on the railroad payroll in this country is considerably over a million and a quarter.

The good times and the extensive improvements set on foot by the railroad companies as the result of their prosperity are responsible for this increase in employment. Eight years ago the number of railroad workers was only 441 for every hundred miles, so that should a return to that standard be possible it would mean the laying off of 312,000 workers, to say nothing of the consequent reduction in the wage standards.

If politicians were wise they would ponder seriously over those figures before passing laws likely to injure this aggregate of good citizens. When you attack a man's purse you make a permanent enemy, and no party can afford to line up railroad people as enemies.

Current Railroad Accidents.

The reports of railroad accidents given by the Interstate Commerce Commission are very discouraging to the friends of humanity who expected to see a material reduction of accidents to trainmen due to the general introduction of safety appliances. The deplorably common accidents that happened to men coupling cars have been almost entirely stopped by the introduction of automatic couplers, but other life taking accidents keep on the increase, especially collisions and derailments. This may be accounted for in the increased speed of trains and to careless habits of those responsible for the movement of trains. A very serious cause of fatalities to trainmen is due to falling off trains. In this connection we believe that many men are killed or injured through the severe shocks caused by accidental application of brakes which frequently causes the collapse of weak cars. An old dilapidated car run between heavily loaded steel cars is a serious source of danger, and it would be a good practice for railroad companies to keep the fragile cars and the battering ram type separate as far as possible.

The practice of using only a few cars equipped with air brakes to control heavy trains is dangerous, and there is good reason for believing that mixed brakes cause shocks that are fatal to weak cars. Railroad men are remarkably chary about reporting accidents due to brakes that habitually give emergency applications instead of service pressure, but the initiated are aware that the Westinghouse and the New York air brakes do not work well together. If the Interstate Commerce Commission would report frankly on the accidents caused by these brakes not working harmoniously together, it would institute a movement to separate the cars and result in prevention of many accidents.

The record of railway accidents compiled by the Interstate Commerce Commission under the law passed March 3, 1901, proved very strikingly the value of automatic block signals in promoting the safe operation of trains. For instance, in one quarter, 765 train collisions were reported and only two of them occurred on roads equipped with block signals, one of them having been caused by a failure in block working, the other where a train was running permissively, that is, having permission to pass danger signals with the train under control.

A deplorably fertile cause of collisions continues to be carelessness about train orders. One illustrative case where a collision resulted from the conductor reading a train order carelessly and telling the engineer what he believed its contents to be, instead of having the engineer read it for himself. This seemingly trifling error cost 22 persons their lives. In connection with this case the Railroad Commissioners urge the extension of the rule that requires not only the conductor and engineer to read the train orders for themselves but to see that the head brakeman and fireman also read them.

There is great reluctance on the part of officials of many railroads to establish the rule requiring brakemen and firemen to be made conversant with every train order, the excuse for the want of this additional aid to the prevention of accidents being that it takes time and that two men are sufficient to guard against mistakes. But the frequency of accidents due to the forgetting of orders is sufficient testimony that two men would be more efficient if they had two more memories co-operating with them.

One cannot read particulars about the fatal collisions without being impressed with the advantage it would be to have the giving and receiving of train orders taken more seriously.

Privileges of the Young Mechanic.

"It is not encouraging to a shop foreman to have his apprentices leave him when they have completed their contract and go elsewhere for employment where the wages are better or where a different line of work is offered which enables a young journeyman to advance and become a thorough mechanic in less time than he could have accomplished the same result in the home shop." The foregoing lines are an extract from a paper presented to a railway club meeting, and expresses sentiments that are widespread among the officials of many railroad shops. It is taking a rather narrow and selfish stand to make reflections upon the fledgling for leaving the parent nest when it has become sufficiently robust to care for itself.

We believe that the majority of railroad shop foremen would pronounce the apprenticeship system to be a failure, and one of the contributory causes for failure in their eyes is the tendency of the young men to go elsewhere when their term of agreed service expires. Another objection that many foremen raise to apprentices is the requirement to advance them from work that has been mastered to other work that has to be learned. When an apprentice has displayed an aptitude for doing a job well the tendency is to keep him at it indefinitely. That is convenient from the foreman's viewpoint, but it is not giving the apprentice the opportunity to learn the trade, and it is only natural that the latter should claim the terms of the apprenticeship contract.

Nor is it fair that the apprentice should be blamed for leaving the parent shop and journeying in search of new experience soon after he has finished the apprenticeship. In the strictest days of the trade guilds, when only privileged classes were permitted to learn trades, the implied understanding was, that soon after his time expired the apprentice should become a journeyman, meaning one who travels from shop to shop in search of extended experience. The trade guilds were very strict in looking after the welfare of their members and all the young men were encouraged to perfect themselves in skill and experience by working in a variety of shops. When such practices found favor long ago, it is scarcely worthy of the enlightenment and liberality of modern times to judge the privileges that were accorded to the workman in a less enlightened age.

Conflicting Opinion on Automatic Stokers.

We are compelled to dissent from some of the views expressed on automatic stokers by Mr. J. E. Muhlfeld in his paper on "Locomotives of Great Power," in which he says:

"Since the introduction of locomotives of great power, the chief consideration in connection with the selection of men for firemen has been to procure the persons of sturdier physique, sufficiently muscled to withstand the manual labor, and who possess, in addition to their physical qualifications, the intelligence that will insure advancement to positions as locomotive engineers.

"With the usual type of locomotive furnace, grate arrangement and draft appliances, the steaming capacity of the boiler is largely dependent upon the quality of the fuel and the method of firing. More especially will this be noted where the distances are long, schedules fast, weather and dispatching conditions unfavorable, and little or no opportunity is given to clean the dirty fires which may accumulate on large grate areas. Under such circumstances, the better the quality of coal used, the more satisfactory will be the results.

"Good firing requires that the proper amount of fuel be supplied to the fire box to meet the demands of the locomotive, and in the case of coal, or solid fuel, it must be placed on the grate at the proper point and time.

"With locomotives of great power, the average fireman is more a means for transferring the coal from the tender to the fire box than an expert to insure good combustion and economy. Therefore, on long runs it may be said that mechanical automatic stoking is not only desirable, but necessary for economy.

"In the use of liquid fuel, the apparatus for feeding the oil to the furnace may be considered as meeting the requirements of an automatic stoker, but with solid and bituminous fuel, the problem is not so simple. Those mechanical automatic stokers now on the market have been designed to feel coal into the fire box in a similar manner to hand firing, and do not accomplish the results desired either as to the labor required to handle the coal, better combustion, or the prevention of large quantities of smoke. From a combustion standpoint, an underfeed type of stoker should give the most desirable performance, and as its mechanical relation with the tender would be such that the labor for handling the coal from the supply to the stoker could be reduced to the minimum, it would appear to be the proper one to develop for locomotive purposes. By underfeeding the fuel, the fresh coal is continually introduced below the fire line, and in rising is brought to the coking stage, at which time the gases are liberated, pass upward through the fire, and are consumed to the last degree, producing as nearly as practicable complete combustion. Such a method, besides providing for a more unform fire and consequent unvarying steam pressure, dispenses with the smoke nuisance, and there should be no waste of unconsumed fuel by loss through grates, or being carried through the tubes and ejected into the atmosphere.

"The application and practical development of a suitable design of mechanical automatic underfeed stoker in connection with the wide fire box, as now generally applied to locomotives, will be looked forward to with much interest."

We consider that the probability of a practicable underfeed automatic stoker being developed is just as promising as the perfecting of a down draft furnace and of many other visionary inventions that certain light-headed people keep dreaming about. A stationary boiler plant provides ideal means for the installation of an automatic stoker, yet all those of the under feed variety are failures. Some fairly good automatic stokers fed in the natural way from above have been invented and the proper thing for sensible mechanical officials to do is to encourage inventors to devise means of overcoming the defective features. The same objections stand against hand firing from above that may be urged against machine firing from the same standpoint, but all the locomotives that have ever hauled trains have been fired from above, and the world has progressed fairly well in spite of that objectionable practice.

Making of a Railway Man.

The successful railroad man is the one, in my opinion, said Mr. L. M. Shipley to the Iowa Railway Club, who nearest reaches perfection in his sphere, be it high or low, large or small. In order to attain perfection one of the qualities, and the principal one, is the ability to do. He does something in an emergency without waiting for positive orders from his superior, and when his superior gives an order he carries it out quietly and quickly without asking innumerable questions about it. In short, he uses his head.

Contrast that sort of man with the one who never does anything except when told, who has to be told everything and then only does part of what he has been told. Every official is looking for the man who does things. They are the ones who are entitled to promotion.

Subordination is another requisite quality in the successful man. How often do you see men who receive orders to do certain work who seem to take delight in seeing how near they can come to not doing it and in some cases positively refuse to do it. Without discipline there would be no good railroad men. All good men make mistakes sometimes, it is only the poorest kind who claim to be always right. Discipline properly administered is a strong feature in making better men. Yet we still find men who have been longest in the service who think that discipline is unwisely administered when it is applied to them.

Economy is also an essential of success. There are a great many men in railway service who fail to realize that the company have to pay for everything that is furnished to them. Some men keep an oversupply of unused material on hand. As an example he cited the case of a small station where, in checking over supplies, 13 bottles of ink were found, 3 dozen lead pencils; this supply would have lasted that station for five years. A year ago, on a percentage basis, the material, etc., charged to operating expenses of "all departments" was 9.5 per cent. of the gross earnings. With a little economy seriously practiced by all concerned this figure was in eight months reduced to 4 1 per cent., representing a saving of about $30,000.

Successful men must possess the characteristics of humanity, ambition, perseverance, honor and a whole lot of common sense with the ability to apply it. Without humanity it is impossible for an official to get the best results from the men under him. A touch of fellow-feeling in a foreman is like a little oil on a machine. Ambition the successful man must also have—that is, the soul-stirring desire to do better, making life and work worth while. The ambitious man will see something ahead of him besides his salary. Perseverance is a most important factor for success. A person may have great genius and ability and lack perseverance and so accomplish very little. Lastly, the successful man is honorable. When a man enters railway service he should feel in honor bound to render to that service the best he is, and when he has fulfilled this requirement to the best of his ability and in some manner has failed or transgressed the rules he should have honor enough to face the facts and tell the truth.

The Underpaid Foreman.

The worst paid class of men doing responsible work in railway service is those who have risen from the position of workman and are given duties that ought to entitle them to good pay. We frequently hear the higher railway officials express regret at the prevailing tendency towards unions and brotherhoods by workmen, and it is common to hear assertions made that supply and demand regulate wages, and that workmen would be just as well paid if there were no unions. The treatment of the lower officials is a standing denial that justice will be given men if they have no means of compelling it.

Remarks made by Mr. W. E. Symons at the Master Mechanics' Convention on the pay of lower officials brought forth the strongest applause of any remarks made in the meetings, and indicated how warmly his hearers sympathized with his views. Mr. Symons said:

I think each member of the association should consitute himself a committee of one when he gets home to talk to his president and general manager in reference to the wages paid to foremen, master mechanics and other subordinates. One reason we do not have more apprentices is because the situation is not sufficiently inviting. We have numerous instances of foremen and master mechanics occupying positions at $50, $65 and $80 a month which ought to pay from 30 to 50, and possibly 100 per cent. more. A man will not endure years of hardship and frequently of privation to fit himself for a position that, when he serves it, the compensation of the position is not equal to that of a machinist or locomotive engineer, or men engaged in the ordinary industrial walks of life. I think as a class we have been somewhat remiss in not talking more to the management of the roads about underpaid foremen and master mechanics when, if we had given them a little more attention the position of mechanical foreman, master mechanic, superintendent of machinery and similar positions would have been more inviting and we would have a better class of apprentices and require fewer rules and regulations to govern and control them.

A Fight in the Master Car Builders' Convention.

In the days when railroad companies were going through the process of evolving the best forms of brakes and couplers for freight equipment, there were many fierce conflicts in the Master Car Builders' Association between the advocates of different devices, and the vigor of the contests stirred the fighting blood, so real in the veins of true Americans. While listening to the spiritless discussions that characterize modern master car builders' conventions we sigh for the excitement of the days gone by. We had been "nodding, nearly napping" one morning at the last convention, when a discussion arose that reminded us of old times. A "caitiff" had dared to question the authority of the time-honored Interchange of Cars Rules, and the convention proceeded to scarify him with hot air and move towards the expulsion from the association of the roads whose representatives had contested the legal power of the rules.

The dispute arose through a movement on the part of ten railroads connecting with Kansas City, Mo., to refuse payment of damages to or loss of cars caused by the great floods and storms of June, 1903. Mr. W. E. Symons, representing the railroads referred to, went before the Arbitration Committee and pleaded for a change of the rules to release railroads from responsibility for loss of cars due to "an act of God." The Arbitration Committee snubbed Mr. Symons, and he brought the case before the convention. He was left to fight the case nearly single handed, but he proved an admirable antagonist and managed his side of the case with consummate skill and knowledge of the legal standing of the controversy.

On the previous evening the Executive Committee of the Association passed resolutions sustaining the action of the Arbitration Committee and "resolved" at considerable length, among other things, "that if payment of said bills shall be refused, or if the said railroad companies decline to assume responsibility for the loss of said cars, then and in that case the membership in this Association of the railroad companies which refuse to pay such bills, or to acknowledge responsibility therefor, shall cease and determine."

At first the impression prevailed that the reading of the resolutions would end in the expulsion being carried by an overwhelming vote, but the full discussion of the questions at issue brought about an entire revulsion of sentiment. Mr. Symons questioned the scope of the jurisdiction of the Arbitration Committee and insisted that its power was not mandatory, but advisory. When a conflict arose between the Arbitration Committee and a railroad company the decision must be with the railroad managers or with the courts. These views were finally concurred in by other members, and the controversy finally ended in the passing of an amendment to the resolution eliminating the penalty portion thereof

"All's well that ends well." We consider that the Master Car Builders' Association has passed through a crisis that might have ended disastrously. Had the recommendation of the Executive Committee been carried to expel from the Association a number of the most important railroads in the country, it certainly would have ended in the disruption of the Association. Expelling an individual or company from any organization is always an exceedingly hazardous proceeding, and such action is peculiarly out of place in such an influential body as the Master Car Builders' Association. Wise counsels prevailed in the end, and it is to be hoped that it will be a long time before such an outburst of foolishness happens again.

Boiler Inspection Law.

The inspector of locomotive boilers appointed for the State of New York under the Bedell law will require all locomotive boilers to be examined every three months very thoroughly. The company is permitted to make the inspection, but the result must be filed with the State inspector. A failure to inspect or file the certificate, or the making of false statements in the certificate, subjects the offender to a fine and imprisonment.

If this law works to prevent locomotive boiler explosions to any decided extent it will be largely imitated by other States.

It appears to be hung up for the present through lack of an appropriation to pay the inspector's salary.

Shops of the Westinghouse Air Brake Company at Wilmerding are now rushed with orders for railroad safety appliances. Since the first of the year the company has received contracts for friction draft gear for 150,000 cars for the following roads: Chicago & Alton, Baltimore & Ohio, Bessemer & Lake Erie; Chicago, Burlington & Quincy, Lake Shore & Michigan Southern, Mexican Central, Lehigh Valley, Pennsylvania, Pennsylvania Lines, Philadelphia & Reading, West Side Belt; Duluth, Mesaba & Northern, Duluth & Iron Range, Northern Pacific and the Butte, Anaconda & Pacific. The company has also received an order from the Missouri Pacific to equip 5,000 cars with air brakes.

The Union Pacific Railroad may establish wireless telegraphy on its through trains from Omaha to San Francisco and Portland. The company is now experimenting with a system of wireless signaling in which the apparatus is attached to the engine cabs. It signals the approach of another locomotive bearing similar attachments. If the device is practicable the overland limited trains will be equipped with the attachments, which will be extended so that an operator will accompany each train and receive and transmit commercial telegrams to stations. The experiments are making in the railroad shops in Omaha.

A compilation of railroad equipment orders placed since January 1 gives a total of 3,600 locomotives ordered, against 675 in the same period of 1904, and 128,000 cars, as against 34,000 last year. Orders for all classes of equipment during May showed practically no reaction in the demand. In freight cars, on the contrary, the ratio of increase for the year to date was more than maintained. Whether the crops are all of "bumper" magnitude or not, railroad managers have concluded that the fall movement of freight will give them use for all the equipment they can get.

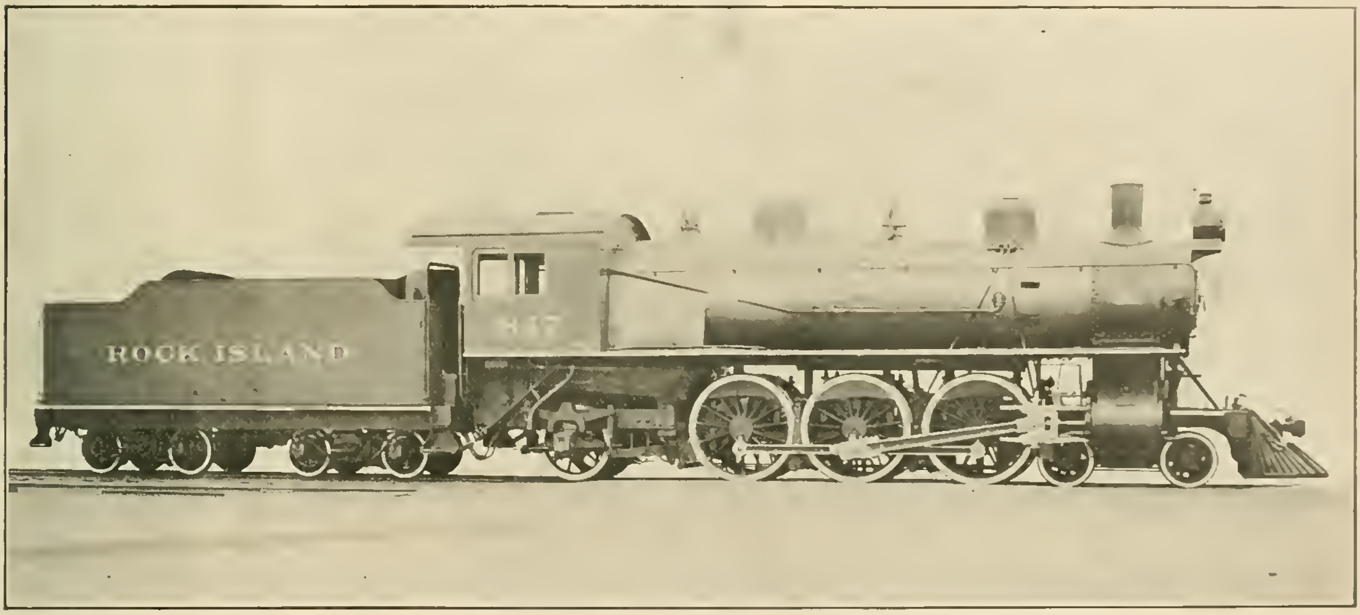
It is said that the management of the Pennsylvania Railroad is considering the feasibility of inaugurating electric service for suburban passenger business out of Philadelphia, and that when a practical plan has been adopted this work will begin. This announcement was made by an officer of the Pennsylvania Railroad, who is experienced in engineering problems and operations as well. He is making a thorough investigation of the cost, and preliminary reports have been submitted to President Cassatt.

Pacific Express Engines for Rock Island System.

The very handsome Pacific type locomotive here illustrated, is one of twenty-four recently built by the American Locomotive Company in their works at Schenectady, for the Chicago, Rock Island & Pacific System. Twenty of these engines have been built with plain slide valves and four, of which this specimen is one, have piston valves and Cole superheater. The piston valves are used with the superheater because there was an impression that difficulty in lubrication would result with slide valves.

The engine has cylinders 22x26 ins. and driving wheels 69 ins. diameter. The boiler pressure carried is 185 lbs., that being considered equivalent to a pressure of 200 lbs. when the superheater is not in use. The engine weighs, in working order, 206,000 lbs., of which 133,800 lbs. are on the drivers, 38,500 lbs. on the forward truck, and 37,200 lbs. on the trailing truck. The tractive power of the engine is 28,682, and the co-efficient of adhesion is 4.7.

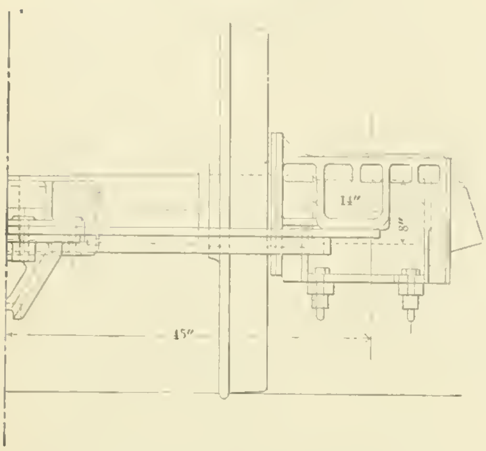
The Cole radial trailing truck which is illustrated by three line cuts deserves special mention. It swings around a central pin in a suitable frame crossbrace. Over the journal boxes, bearings of hardened steel seats and rollers are interposed to avoid friction. These rollers act transversely and allow the truck to swing freely. The farther the truck is displaced laterally the greater the incline becomes on which the rollers move, and an increasing resistance is experi-

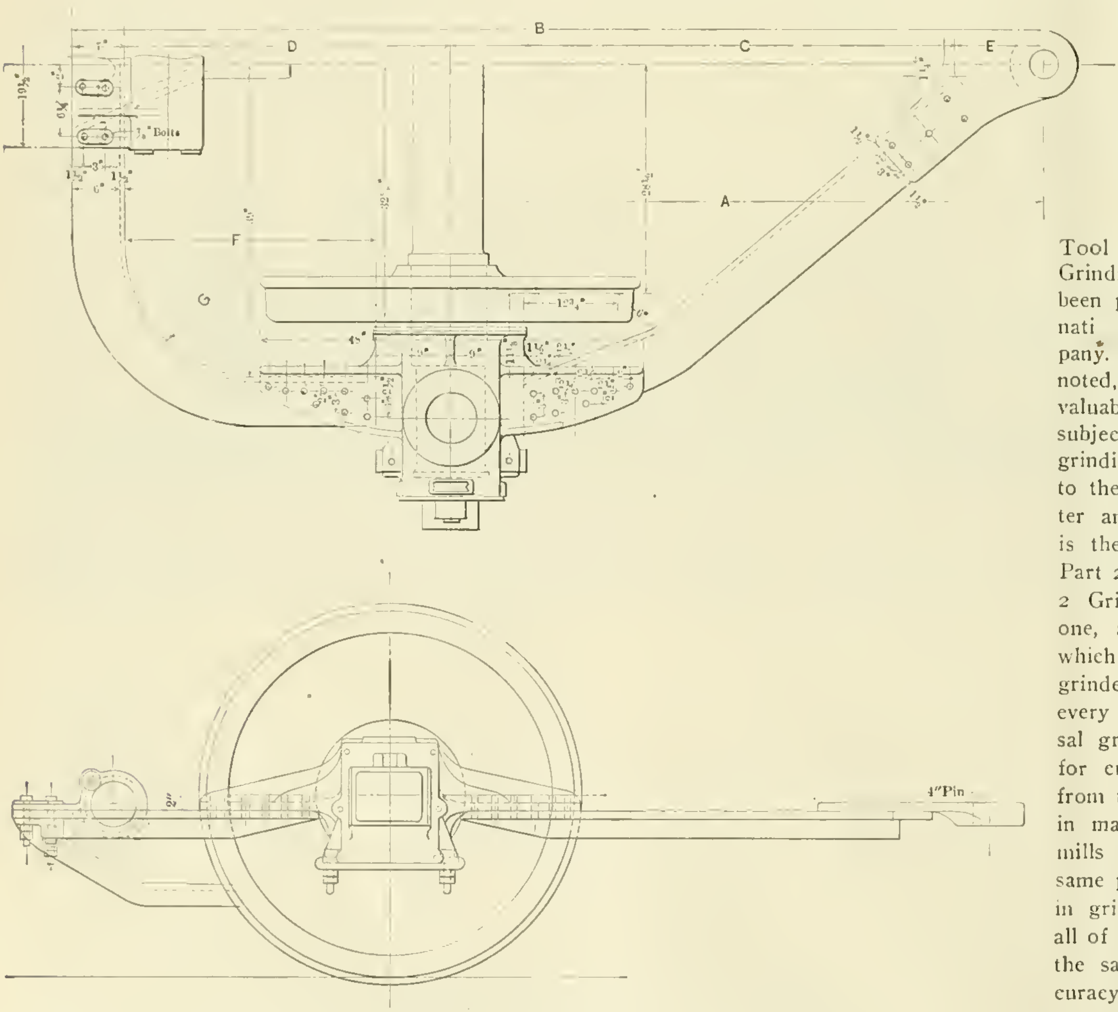


PACIFIC EXPRESS ENGINE FOR ROCK ISLAND SYSTEM.
T. S. Lloyd, General Superintendent Motive Power. American Locomotive Company, Builders

enced which tends to return the truck to its central position.

An additional feature is used to aid this action, the back ends of journal boxes being connected by a "U" bar which has a spring housing mounted at its center; the whole being connected up





COLE FLEXIBLE TRUCK FOR ROCK ISLAND PACIFIC ENGINE.

with a crossbrace between frames back of axle.

Joint action of these devices take side thrusts, which would otherwise be resisted by the wheel flanges; any tendency for the truck to hunt or swing from side to side is obviated; and any blows which occur when the engine enters or leaves a curve are properly resisted.

Cast steel enters largely into the construction of this truck.

Buda Foundry Car Replacer.

The Buda Foundry and Mfg. Co., of Chicago, have perfected and put on the market a new replacer which claims special attention. The main features of the Buda replacer is a groove that protects the flange, the tread of the wheel being first engaged preparatory to mounting. By this means a great increase in friction is secured and the shock is reduced to a minimum. The tendency to move the replacer out of position is also obviated. The thinness of the approach is also an admirable feature, and this is accomplished without impairing the necessary strength, and as a consequence a gradual and easy ascent is accomplished. The inner replacer is so constructed that the wheel in mounting is forced toward the rail, while the possibility of the wheel dropping on the other side of the rail is absolutely avoided.

Convenient carrying handles are provided, and the Buda replacer is altogether an important and necessary addition to railroad equipment.

Root Pressure Regulator.

A very effective pressure regulator valve has been invented by Mr. H. C. Root, an engineer on the Toledo, St. Louis & Western. It is a double headed piston connected with a regulating spring. A sudden rise in the supply pressure throws no extra stress on the spring, nor does it affect the reduce pressure in the least. Should the supply pressure fall below the amount required in the reduced limit the piston structure will assume its lower position and the reduced line will receive the entire supply pressure. The pressure is drawn practically direct and the pressure governs. No hammering, no diaphragm to break.

This device may be used in any place where a reduced pressure is desired; as, for instance, in water mains, natural gas mains, air plants, steam plants, a regulator for car heating and many other places too numerous to mention.

A new Treatise on Tool Room Grinding and Grinding Machines has just been published by the Cincinnati Milling Machine Company. This book, it will be noted, contains considerable valuable information on the subject of cutter and tool grinding. Part 1 is devoted to their No. 1 Universal Cutter and Tool Grinder, which is their well-known machine. Part 2 is devoted to their No. 2 Grinder, which is a new one, and covers a field for which there has been no grinder thus far. It is in every sense a complete universal grinder, and has a range for cutter and tool grinding from the smallest cutters used in machine shops up to face mills 24 ins. in diameter, the same principle being employed in grinding all of them, and all of them being handled with the same high degree of accuracy and convenience. The numerous illustrations show exactly how to handle the work, and the descriptions in connection with them give data on cutter grinding, no matter what machine is used.

Hamlet's grave at Elsinore is to be desecrated by being run over by a railway.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. When a student wishes to receive a private answer, he is reminded that it is usual to send a stamped envelope for the return letter. We will be glad to answer any question relating to railway matters, but prefer that they be suitable for our question and answer department. All letters intended for Our Correspondence School ought to be addressed to Department E.

We receive daily testimony from those studying this course that many readers are inclined to magnify the difficulties and stall without trying the steepness of the grade. For these people's benefit we publish the following article:

Formulas and Calculations.

As many of our correspondents express annoyance when it is necessary for us to use algebraic signs, we publish the following article to show how easy it is to understand the signs if they are given a little serious consideration.

The article forms the first chapter of "Practical Shop Talks," by F. H. Colvin, a most valuable book for mechanics and engineers, costing only 50 cents.

Whenever I hear a few men kicking about a few letters, a square root sign and straight line, commonly called a formula, it recalls my own experience with a small bored one, and how the boss showed me what a fool I was for throwing the paper down without tackling it, for 'twas something I had been asking him about that very day. We were talking about shafting, and when he happened to remark that a 4-in. shaft would weigh four times as much as a 2-in. shaft, I dropped the hammer on the floor and looked at him. Then I happened to pick up a paper that noon which had this in it: "Weight of an iron shaft $= d^2 \times .7854 \times .28$, $d =$ diameter of shaft." This was just what I wanted, but what did those idiotic letters and figures mean? After looking at it three seconds and a half I fired it under the bench and went to play cards with the boys.

Boss saw me, and that night he said: "Ike, I don't like to say it, but you're an idiot to give up such a simple thing and go off without learning what that meant." "But I'm no algebra-rion, or whatever you call it," said I; "those letters and things don't mean anything to me; they're for scholars and bosses." "Ike, what do you take that paper for—for fun or to learn something?" "Why, to learn, I suppose, but ——" "No buts; you didn't believe me about that shaft this morning; to-morrow we'll prove it by weight, but to-night we'll tackle that formula and see why it is so. In the first place, let's see if you really know what .7854 is. Don't, eh? Well, it's a 'constant,' or a number which shows the relation of the area of a circle of any diameter to a square of the same diameter. If a square plate of iron weighs 10,000 lbs., then the largest circle that can be cut from this will weigh 7,854 lbs. Don't believe that, either, eh, or don't see how I know? Well, come into the druggist's. Now, here's a card 4 ins. square, and it weighs—let's see—100 grains. Now, we cut a 4-in. circle out of it and that weighs about 78½ grains, near enough in our rough experiment to show what I mean. Now, you can put this down as a fact, that a circle contains $\frac{7,854}{10,000}$ or .7854 the area of a square of the same diameter. Here is a card 8 ins. square, which weighs 400 grains; cut a circle out of this and it will weigh 314 grains, or four times the weight of the 4-in. circle, just as the 8-in. square weighs four times as much as the 4-in. square; so, you see, Ike, the weight varies as the square of the diameter. Don't quite see that? Well, then, $4 \times 4 = 16$ and $8 \times 8 = 64$; 64 divided by $16 = 4$, showing that the area is four times in this case, because 8 ins. is twice 4 ins., and 2 squared $= 2 \times 2 = 4$. You can also put it down that the areas of similar figures vary as the square of their similar dimensions. Thus, a 2-in. circle contains $2 \times 2 \times .7854 = 3.1416$ sq. ins., while a 6-in. circle contains $6 \times 6 \times .7854 = 28.3744$ sq. ins., or 9 times as much, which we can find by saying 6 equals 3 times 2 and 3 squared equals 9, so the area must be 9 times as great. D equals diameter of shaft, then d^2 means diameter squared or multiplied by itself. Take a 2-in. shaft: $2 \times 2 = 4$, $4 \times .7854 = 3.1416 \times .28 = .879 +$ pounds per inch of length.

Why do we use .28? Because one cubic inch of wrought iron weighs 28/100 of a pound, and that makes this a 'constant' also. Any number which we use in this way, as the weight of a gallon of water, a cubic inch of iron, or the foot-pounds in a horse power is a constant. These are found by experiment and accepted as correct, after being proved in this way: we know that the circumference of a circle is 3.1416 times the diameter, regardless of the diameter, it being found by accurate measurement and can be verified by careful experiment.

But to resume. Take a 4-in. shaft and see what it weighs per inch. $4 \times 4 = 16$, $16 \times .7854 = 12.5664 \times .28 = 3.516 +$ pounds per inch. We'll prove this to-morrow. Now, right here let's see what we can learn about the relation of diameters and weights. Squaring the diameter of the 2-in. shaft we get 4, and with the 4-in. shaft we get 16, or four times the square of 2, then without going further we know that it will weigh four times as much, as areas vary as the square of the diameter. Now, Ike, think this over, and if you don't see it, tell me, but work at it till you do, and don't be afraid of a few letters till you try and see if you can't find what they mean, for it's so much handier than using a whole string of words which wouldn't tell any more, after you know how to read formulas. Good night, Ike; study it out."

Well, I did, and when I got home I tackled another one, which may be of interest. Weight of iron plates per square foot = thickness in eights $\times$ 5. Iron 5/16 in. thick, 2x3 ft, what is the weight? Then $5/16 = 2½$ eights, $2½ \times 5 = 12½$ pounds per square foot, $2 \times 3 = 6$ square feet, $6 \times 12½ = 75$ lbs. as weight of plate; it's a very simple affair, but it is a handy one, and many others are just as simple.

Triple Valve.

52. How many kinds of triple valves are there in general use?

A. Two the plain type and the quick action type.

53. What is the function of the triple valve piston, the slide valve and the graduating valve?

A. The function of the triple valve piston is, by variation of pressures on its two sides, to move the slide valve on its seat to the application, graduating, and release positions, and to open and close the feed groove in the piston bush. The function of the slide valve is, by movement due to the triple valve piston, to make connection between the auxiliary reservoir and brake cylinder, applying the brake, and to make connections between the brake cylinder and the atmosphere, releasing the brake. The function of the graduating valve is, from movement given by the triple piston, to admit pressure gradually from the auxiliary reservoir to the brake cylinder, in response to reductions made in the train pipe pressure.

54. Explain how the quick action

triple operates when making an emergency application of the brakes.

A. A sudden reduction of pressure in the train pipe will cause the triple piston and its parts to be moved to quick action application position, which first throws into operation the emergency feature of the triple, admitting train line pressure to the brake cylinder, after which auxiliary reservoir pressure is permitted to pass to the brake cylinder, where a higher pressure is obtained than in a full service application of the brake.

55. Name the parts of the quick action triple valve that are not in the plain triple valve.

A. The emergency piston, the rubber-seated emergency valve, and the non-return check valve and its spring.

56. Where does the air come from which sets the brakes in emergency with the plain triple valve?

A. From the auxiliary reservoir only.

57. Where does the air come from which sets the brakes when an emergency application is made with the quick action triple?

A. The first portion of air going to the brake cylinder is contributed by the train pipe, after which the auxiliary reservoir sends in its portion of air to the brake cylinder.

58. What causes a blow at the triple valve exhaust, and how may it be located?

A. This blow may be from three sources, the train pipe, the auxiliary reservoir, or the brake cylinder. If the blow is from train line pressure, it may be detected by closing the stop cock in the cross-over pipe, and the brake will promptly apply. If the blow is caused by auxiliary reservoir pressure, there will be a steady leak of pressure at the exhaust port when the brake is released and the brake will not apply when the cut-out cock is closed in the cross-over pipe. If brake cylinder pressure causes the blow, it will only happen when the brake is applied and will cease when the brake is released and the brake cylinder empty of pressure.

59. About how much time is required to charge the auxiliary reservoir to 70 pounds in the train pipe.

A. It should be no less than 45 seconds and no more than 70 seconds.

Train Air Signal.

60. Explain in a general way the operation of the whistle signal reducing valve.

A. The valve consists of an adjusting or regulating spring which limits the amount of pressure which will pass through the valve, a piston and a supply valve. If the spring is adjusted for 40 pounds, the standard pressure, the piston will descend and permit the supply valve to close when 40 pounds has been reached, thus shutting off further supply to the signal line. If the signal line reduces below 40 pounds, or what the valve is adjusted for, the adjusting spring and piston will permit the supply valve to open and admit main reservoir pressure, until the predetermined amount has been accumulated, when the supply valve will then be closed.

61. Explain how the signals are transmitted from the car to the engine.

A. On the engine is a valve containing a rubber diaphragm, on the under side of which is suspended a stem which, when raised, will permit pressure to pass from the signal valve outward through the air whistle. When the pressure on the top side of this diaphragm is equal or greater than that on the under side, the stem will remain seated, closing the port to the whistle; however, if a reduction be made in the chamber above the diaphragm, or in the signal line connected to this chamber above the diaphragm, the greater pressure on the under side will cause the diaphragm and stem to rise, permitting pressure to pass to the whistle producing the blast.

62. If the signal whistle blows when brakes are released where would you look for the trouble?

A. In the pressure reducing valve. Dirt or other foreign substance has settled between the supply valve and its seat, thus permitting main reservoir pressure to accumulate in the signal pipe. When brakes are released, main reservoir pressure falling below the signal line pressure, will permit the signal line pressure to pass backward into the main reservoir, making a reduction in the signal pipe and on the top of the diaphragm on the signal valve, thus producing the blast the same as if a reduction were made at the car discharge valve.

63. If the proper discharge of air is made at the car discharge valve, and the whistle on the engine only responds with a weak blast, where would you look for the trouble?

A. The car discharge valve may be partially choked, or the diaphragm stem in the signal valve may be loose, responding poorly to a signal line reduction. Also, the adjustment of the whistle bowl on the stem should be examined. Sometimes wind blowing across the whistle bowl when running may weaken the blast.

Questions Answered

OIL REQUIRED FOR HEAVY ENGINES.

(67) R. C., New Albany, Ind., writes: We have a 4-8-0 class freight engine weighing about 176,000 lbs. Advise what you consider proper allowance of engine oil per hundred miles. Also of valve oil not incluidng rods. A.—Lubrication experts recommend, under usual conditions, for the 4-8-0, 21x26 in. freight engines, on through trains, a mileage of 75 miles per pint of valve and 35 miles per pint of engine oil. On local freights, they recommend mileage of 60 miles per pint of valve and 30 miles per pint of engine oil. On 100-mile basis this would be for through freights 1⅓ pints of valve oil and 3 pints of engine oil. On local freights, 1⅔ pints of valve and 3⅓ pints of engine.

SLOW RELEASE OF BRAKE.

(68) A. A. I., Utica, N. Y., writes: On one of our freight engines recently out of the shop, the brake cylinders were cleaned, triple new packing ring applied, and also brake rigging fixed. When engineer would apply brakes they would stay set, but would take a long time to release in recharging train line. Would this be due to air leaking by packing ring, or would it be in connection with the rigging? A.—Possibly the triple valve is too small for the large brake cylinders on the big engine, thus requiring a long time for the brake cylinder pressure to escape through the triple valve exhaust port. If the packing ring is poorly fitted, train line air may be feed past it quicker than if it were a good fit. Possibly the piston travel of the brake cylinders is quite long, which would also cause a longer time for the brakes to release. If this latter is true, the slack should be taken up in the brake rigging.

SETTING VALVES WITH DIRECT MOTION.

(69) F. T. W., Norwalk, O., writes: When setting inside admission direct connected valves, will the tram marks on stem which indicate the lead, come between the port marks or outside them? —A. The tram marks on the stem indicating the lead will come outside the port marks.

(70) E. E., Fort Wayne, Ind., writes: I have a question which I would like to have answered. What is the cause of the brake setting in emergency, when brake valve is in full release position? A.—The rubber seated emergency valve is probably held off its seat by foreign substance, thus allowing pressure to pass from the train line through the emergency valves direct to the brake cylinder. Tapping the triple valve sharply, but lightly, will generally dislodge this dirt, permit emergency valve to resume its seat, and thus remove the trouble.

(71) R. E. B., Lehighton, Pa., writes: Last week a train coming through the yard broke a knuckle, the train stopped and the brakes went on in emergency. They then threw out that car and backed up to the last part of the train, coupled up, and the engineer released

his brake, all but two brakes, and those would not release. The retainer handle was down. A brakeman came along, took a knuckle pin and hammered on the cylinder cap, then the brake released. Now, what was the trouble? A.—In the emergency application, the emergency ports opened to admit train pipe air to the cylinder, and dirt of some nature lodged between the valve and its seat, thus keeping the brake set as long as there was air in the train pipe. Hammering the cap of the valve loosened the dirt and permitted the valve to reseat, thus doing away with the trouble.

(72) R. E. B., Lehighton, Pa., writes:

If you were testing a car with the reservoir fully charged up, and you make about a 5 lb. reduction, the piston comes out a little over the leakage groove. If the graduating valve is leaky, will the piston move out a little or will it stay so until the brake releases? A.—If the leaky graduating valve permits auxiliary reservoir air to pass to the cylinder, the reservoir pressure will become lower than the pressure remaining in the train pipe and the triple valve will go to release position and the brake will release.

(73) R. E. B., Lehighton, Pa., writes:

If you charge your reservoir up fully, close the cut-out cock in the cross-over pipe, then let all the air out of the train line, leave the angle cocks open, and quickly open the cut-out cock, which will cause the brake to apply in emergency; will that operate the quick action parts, and will you get any of the train line pressure, and about how much? A.—The brake will apply satisfactorily, but in full service only, as the amount of air in the train pipe lying between the cut-out cock and the triple valve is hardly sufficient to cause any perceptible increase in brake cylinder pressure in an emergency application of the brake.

THROTTLING DOUBLE-TUBE INJECTOR.

(74) P. H. O., Woburn, Mass., asks:

What is the proper method of throttling a double-tube injector so as to use the least steam? As the steam from the boiler lifts the water through a special set of tubes, and any diminution of pressure lowers the supply of water, would it not be all right to control the supply of water entirely by the valve at the boiler, keeping the injector regulating wheel in the position of highest capacity?—A. The supply of water in a locomotive injector of the so-called "double-tube" type cannot be controlled by the valve at the boiler. The reason is that the lifting set of tubes has no independent boiler valve, but a common valve supplying steam both to the lifting and to the forcing set of nozzles. If the boiler valve were to be cut down for the purposes of the lifting set, it would naturally influence the forcing part of the injector in an unfavorable manner. If the lifting set would have an independent boiler valve, the method of regulation suggested might be used with good results.

TO CALCULATE STRENGTH OF BOILERS.

(75) Boiler Maker's Apprentice, Ft. Wayne, Ind., writes:

I have been trying to find an easy way to calculate the strength of an ordinary boiler. I am no high school graduate, and the outlandish signs they put in books that are supposed to tell about boiler rules make me tired. I can work plain figures, including the rule of three, but I am more familiar with crow feet than with logarithms. Can you give me a common sense rule? A.—You are like many other mechanics who magnify common signs into mysteries. Read the article on Formulas and Calculations in this department.

Now about the problem: The bursting pressure of a boiler shell is found by multiplying the tensile strength of the material in pounds per square inch by the thickness of the shell in inches, and dividing by the radius in inches. *Example:* What is the bursting pressure of a steel boiler (the tensile strength being 55,000 lbs. per square inch), 60 ins. diameter and 3/8 in. thick, with double riveted longitudinal joints whose efficiency is 70 per cent? Answer—Bursting pressure equals 55,000, the tensile strength multiplied by 3/8 multiplied by 70 divided by 30, the radius, and gives 481 lbs. per square inch. The problem is stated: $55{,}000 \times 3/8 \times 70 \div 30 = 481$ lbs. per square inch.

A New School of Air Brake Instruction.

The interesting demand for all engine men and train men to be thoroughly informed on air brake practice is so greatly felt on all railroads that the question of instructing such employees has become an important problem with railway officials. A new school of air brake instruction has recently been established at Meadville, Pa., under the name of the Dukesmith School of Air Brakes. Mr. Frank H. Dukesmith is the director and president of the school, and as he enjoys an international reputation as an air brake man, the success of the new school seems assured. Mr. Dukesmith was formerly superintendent of air brakes for a portion of the Gould system in the Southwest, and is the author of the air brake book entitled "Modern Air Brake Practice—Its Use and Abuse." He is also president of the Dukesmith Air Brake Co., of Pittsburgh.

INSIDE ARRANGEMENT OF ERIE STEEL MAIL CAR.

President H. H. Vreeland, of the New York City Railway, and President F. M. Hoffstot, of the Pressed Steel Car Company, and a large number of officials made a trial trip last month over the New York surface lines on a steel car of a new pattern made by the Pressed Steel Car Company. The company's experiment with steel cars may lead to replacing the present wooden cars. Mr. Vreeland is generally in the front with improvements.

Telephone Train Dispatching, B. & O.

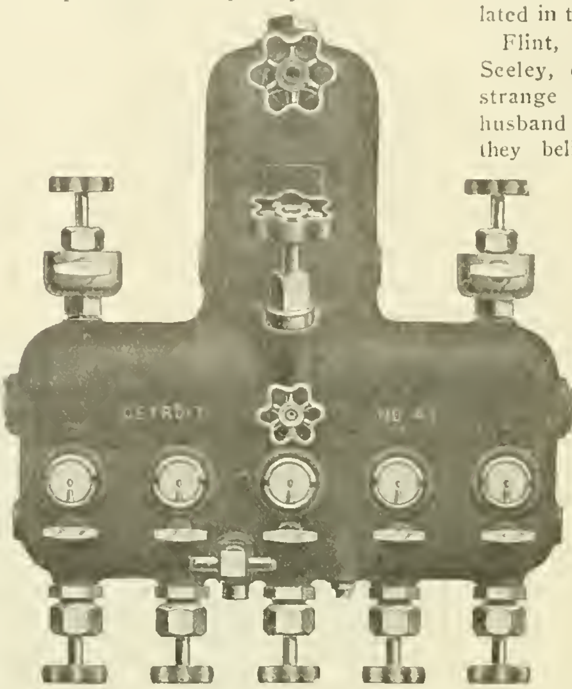
The Baltimore & Ohio Railroad claims the distinction of being the first steam railroad to systematize the use of the telephone for the movement of trains. A conference of the dispatching staff was held recently, in Baltimore, and a set of rules and forms was prepared so as to reduce the method of handling trains by telephone to a standard. Mr. Chas. Selden, superintendent of telegraph, was chairman of this conference. Every non-telegraph station that has a passing siding is to be fitted up with a telephone connection to the nearest telegraph office. This will enable the transmission of train orders from the telegraph office to the train crews at such sidings, or to an employee stationed there for that purpose.

For some time the Baltimore & Ohio Railroad has been extending the use of the telephone for the transmission of ordinary business messages, connecting the division headquarters with the terminals of the divisions by means of the "composite" telephone method. This system admits of the simultaneous working of the wires telephonically and telegraphically without interfering with each other.

In addition to these long circuits the telephone is used extensively in single track blocking, and for the movement of yard engines and the connection of non-telegraph stations with telegraph stations, by which trains are moved from the former to the latter, where the ordinary telegraph orders are received. In this manner the telephone is used for single track blocking between Newark and Bellaire, Ohio. The telegraph offices average about eight miles apart, and at many points the siding extends beyond the telegraph office a distance of about two miles. By having the telephone located at the switches, a train is therefore allowed to use the passing siding up to the outlet switch. Then as soon as the train for which it has been held has passed, the conductor notifies the operator in the block signal tower and he is given permission to proceed with his train to the next block signal office. In this way the blocks are practically cut down so far as main track use is concerned, just so much as the side tracks extend into the blocks. In some instances it permits of the use of four miles of passing tracks, leaving but four miles of main track to be covered by the blocking. The result is that it practically shortens the block by one-half the distance and hastens the movement of traffic to that extent. This method of using the telephone between Newark and Bellaire, over 104 miles of single track, has been in use for about two and a half years with great success. It is a system that very much facilitates the handling of traffic and is perfectly safe in the movement of trains.

The Detroit Five Feed Locomotive Lubricator.

The Detroit No. 41 Five Feed Locomotive Lubricator, bullseye pattern, is attracting a good deal of attention at the present time, especially in connection



DETROIT FIVE FEED LOCOMOTIVE LUBRICATOR.

with balanced compound locomotives. It performs the same service as has been done by two lubricators (one double feed and one triple feed) in the past and it takes up much less space in the cab. The feeds can be arranged to feed against either high or low pressure as may be desired.

Phantom Train.

Many of our local readers are familiar with the legend of the phantom train that is said to have been frequently seen approaching the old bridge over the Jacques Cartier river on the then main line of the Lake St. John Railway at St. Gabriel as if coming from Quebec, and then suddenly disappearing. So many of the good people of Valcartier and St. Catherine's claim to have witnessed this strange appearance and are ready to this day to vouch for its truth upon oath that it is impossible to doubt that they really saw something, at times, which was calculated to create the impression of an approaching railway train. They describe this impression as that which would be caused by the headlight of a locomotive running at night towards the bridge from Quebec, and the flashing of the lights in the windows of the cars it was drawing. Various theories were propounded to account of this unusual phenomenon. Mirages, peculiar states of the atmosphere, will-o'-the-wisp fires and many other things have been put forward to explain it. Even the supernatural was dragged in to serve the purpose, but to this day the mystery has remained unsolved. Another case of the same kind has just presented itself in Michigan, which will interest all acquainted with the Valcartier-St. Catherine's story. It is related in the following despatch:

Flint, Mich., April 3.—Mrs. Fred Seeley, of Whigville, has reported a strange phenomenon. She, with her husband and a few friends, saw what they believed to be a fully equipped and speeding passenger train on the tracks of the Pere Marquette Railway, a few miles from their house. They saw the train come to a full stop and noted the lights in the windows. Then there seemed to be a catastrophe of some sort, and the whole train was seen to be in flames in a short time.

Mrs. Seeley's husband, with a man employed by him on his farm, took a lighted lantern and started for the scene of the supposed fire. On their way they saw approaching the regular passenger train due here at 7.05. To their horror this train, which was the real one, kept on at a terrific pace towards the burning cars. It reached the scene and passed through it with a roar. Mr. Seeley and his companion kept on and reached the place where they supposed there was a burning train. They found nothing. Their report of the strange affair has been listened to with interest. All the people are well known locally and well thought of.—Quebec *Telegraph.*

The B. F. Sturtevant Co., of Boston, Mass., has recently secured the contract for furnishing five complete sets of heating and ventilating apparatus for the Allegheny County Jail, Pittsburgh, Pa., each set consisting of a plenum fan and an exhaust fan, both driven by direct-connected engines and connected with heaters and tempering coils.

President Roosevelt said that a hundred thousand dollar man was needed for president of the Panama Canal Commission and he selected a railroad official who began towards the top and never displayed the least indication of possessing the ability that would have commended him to the position of brakeman.

To doubt and be astonished is to recognize our ignorance, and this is the first step towards acquiring knowledge. —*Lord Chesterfield.*

Air Brake Department.

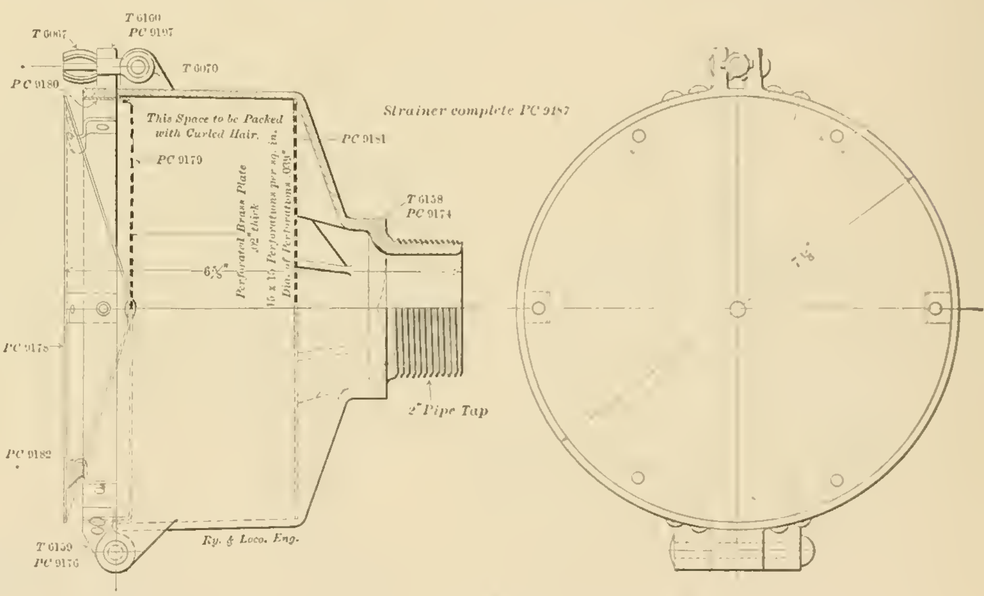
CONDUCTED BY F. M. NELLIS.

Air Strainer for Air Pump.

The accompanying sketch illustrates a strainer, made by the W. A. B. Co., for filtering the air drawn into the air cylinder of the air pump. It is of large diameter, 7⅜ ins., thus giving the air a sluggish current, and allows the dirt in the air to be deposited in the curled hair instead of being sucked through into the air pump.

As will be observed, the strainer consists of an outer casing containing two perforated screens, the space between being filled with curled hair. A hinge arrangement permits a ready removal of the inner parts for cleaning purposes. The concave face plate prevents the immediate contact of snow, grease, flying sparks, etc., with the strainer perforations. The annular space for the entrance of air is much greater in area than the opening through the receiving valves, admitting readily clean atmospheric air to the air cylinder of the pump.

The curled hair may be removed and cleaned with a steam jet or kerosene bath, or may be replaced with new curled hair. A season's service trial of this strainer has demonstrated that it is a great protection to the air cylinder, and largely lessens the wear of the packing rings and the cylinder walls.



AIR STRAINER WITH HINGED COVER.

Air Brake Matters at Master Car Builders' Convention.

The air brake matters taken up at the convention of the Master Car Builders' Association at its annual convention recently adjourned, of interest to air brake men in general, are as follows:

The committee on triple valve tests reported that it had tested no new triple valves during the past year. The committee, however, believed that developments in triple valves were now going on from which railway companies might expect some very interesting information in the very near future, and which would revolutionize air brake practice quite as much as did the automatic brake when it was developed from the straight air brake.

The committee on brake shoe tests reported that it had tested four brake shoes during the past year, one from the Southern Pacific Railroad, one from the Central Railroad of New Jersey, and two from the Chicago, Indianapolis & Louisville Railroad. Nothing of unusual importance had developed in the test of these shoes except to indicate that the steel backed brake shoe was indispensable for high speed brake and modern service. Persons especially interested in the subject of brake shoes would do well to read the committee's report in full.

The committee on air brake hose reported that the greater percentage of defects in hose were due to causes for which the manufacturer was not responsible. Some causes for defective hose were due to the fact that the M. C. B. specifications, calling for the train pipe 13 ins. from the center line of the car and the angle cock slanted inward 30 degrees from a perpendicular, were not fulfilled. The committee believed that the M. C. B. label on the hose should be copyrighted to prevent unscrupulous manufacturers from making use of said high grade label on inferior hose. The committee further recommended that the manufacturers produce at lower cost a better medium grade of hose.

In response to a question of a member regarding train men going between cars, Mr. Moseley, secretary of the Interstate Commerce Commission, said that men now have to go between cars to couple and uncouple hose. He further advised that there were automatic air couplers now in practical service, having merged from the experimental stage, and has been in use for a year or more on the entire passenger equipment of the Long Island Railroad, and that such service had demonstrated the device to be worthy of more general application. He believed that such application would follow in the near future, and that it would be equally as important an event as was the adoption of the automatic air brake and the automatic car coupler of the M. C. B. Association.

A committee on brake beams was appointed to continue its work on revision of the dimensions of brake beams.

A committee was appointed to investigate and improve the M. C. B. specifications for high speed brake foundation gear.

A member suggested that since it has become necessary under the Safety Appliances Act to have 50 per cent. of each train controlled by air brakes, the number of accidents due to burst air brake hose had increased considerably. This seemed to call for an air brake hose of better quality, and the member recommended that a rule be embodied in the code making the use of air brake hose in accordance with the M. C. B. specifications obligatory. The Arbitration Committee acquiesced in this belief, and recommended the adoption of the following rule, which was adopted by the convention: "Air brake hose applied to foreign cars after July 1, 1906, shall be considered wrong repairs unless they are made in accordance with the M. C. B. specifications and are so labeled."

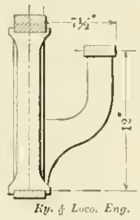
The Arbitration Committee recommended the following changes, which were adopted:

Angle cocks, grinding in............25c.
Cleaning, oiling, testing and stenciling cylinders, price to be increased to ....30c.
"Cleaning, testing and stenciling" to be increased to...............23c.
Triple valve removed, cleaned, oiled, tested and stenciled, to be increased from 24c. to............36c.
Cleaning, testing and stenciling, to be increased from 6c. to..........18c.

in order that the total charge may be made up. The committee was of the opinion that the price allowed for this work, according to the old schedule, was inadequate, as experience had shown, and the prices should be increased to the figures named.

Bad Design of Brake Beam Hanging.

One of our southern correspondents sends us drawings of a defective method of hanging brake shoes and beams, which are illustrated herewith, and which is admittedly a very bad design. As will be seen by reference to the illustrations, the brake shoes and



A GOOD DESIGN OF BRAKE BEAM HANGER SUPPORT.

beams have a very short hanger, which is inclined upward from a horizontal line, and undoubtedly would result in many slid flat wheels. These skidded wheels, as our correspondent states, are always found on the leading pair of wheels in the truck. It will be readily seen that the leading wheels would be more severely acted upon, inasmuch that the toggle joint effect of the hanger and the shoe on the wheel is greater than it would be with the following pair of wheels in the truck, which would not be endangered until the car ran in the opposite direction. This matter is made much worse by the use of a brake head whose attachment to the brake hanger permits of 1½ ins. slack motion. This design is a faulty one and should not be installed upon air-braked cars.

New Air Brake Association Questions and Answers.

The New Book of Progressive Form of Questions and Answers on the Air Brake comprises both the Westinghouse and New York systems, is revised and new throughout, and has been brought right up to date, June, 1905.

It is splendidly printed on white, hard, glossy paper, with clean type and neat, clear-cut illustrations, expressly prepared for this purpose.

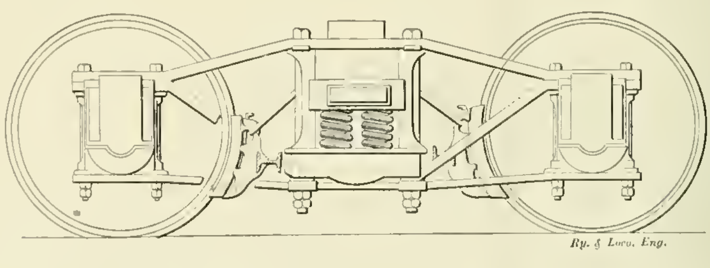
The illustrative and descriptive work has been performed by specialists from both brake companies, while the practical road and terminal work has been done by actual railroad service men, called in for the purpose from the firing line of daily experience.

Both the Westinghouse and New York brake valves and triple valves are shown in all their several working positions; also the air pumps, governors, retaining valves and all valves in the signal system, and high speed brake are shown in all positions, open and closed, operative and non-operative. Care has been taken to make the book as clear and thorough as possible.

The carefully constructed and comprehensive character of the book makes it equally serviceable to both the beginner and the advanced student.

Every man in locomotive, car, train, shop and roundhouse service and railroad office should possess the book. It has no superior as a work of reference on both systems of brakes, and is a thorough air brake instructor. It is a complete air brake course in itself, and will pass the student on any examination.

The book is 6 ins. by 9 ins. in size, and contains 380 pages, about two hundred beautiful illustrations and nearly two thousand comprehensive questions and answers. Neatly bound in handsome, illustrated paper cover, it will be sent, prepaid, to any address in the United States, Canada and Mexico for $1.50; or in handsomely bound, rich Russia leather, for library or more substantial use, prepaid, for $2.00. Send orders to this office.



AN INSIDE DESIGN OF BRAKE WHICH IS NOT GOOD.

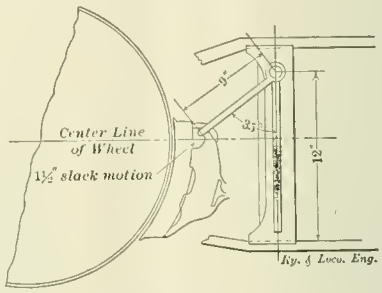
CORRESPONDENCE.

Some Practical Roundhouse Points on the Air Pump.

If a 9½-in. air pump stops, to locate the cause shut off the steam from the pump for a short time, then turn on the steam quickly. This will start the pump that has stopped on account of having the gasket partly blown out in the top head (in a manner they always blow out, as described in RAILWAY AND LOCOMOTIVE ENGINEERING some time ago) every time, and will in some cases start a pump that has stopped on account of being dry.

If the pump still refuses to start, shut off the steam, remove the reversing valve chamber cap nut, drop a little valve oil in the reversing chamber, replace the cap nut and turn on the steam. If it then refuses to start, tap it lightly on the left main valve head, but not on the reversing valve cap nut.

If the pump still refuses to start, open the drain cock and see if the pump



FAULTY DESIGN OF BRAKE BEAM SUSPENSION.

is getting steam, and if it is not, the fault lies in the governor. If steam issues freely from the pump, the governor is O. K. Open the drain cock in the lower end of the steam cylinder next, and if the steam issues freely, the pump is on the up stroke. If the steam does not come out of drain cock freely, then the pump is on the down stroke. Now shut off the steam and remove the reversing valve chamber cap nut. If the valve is at its lowest position, the trouble is likely due to a reversing plate stud being out, and cocked in such a way as to prevent piston from finishing its stroke, or it may be the steam piston head is off and is cocked in the steam cylinder. If the latter, a strong blow will be heard at the front end the same as if the blower was turned on.

If, on removing the reversing valve chamber cap nut, we find that the reversing valve is at its highest position, the trouble is in the main valve. Likely the rings in the small piston are worn out, or a piece of pipe cutting or other metal worked in the main valve in such a position as to prevent the main valve from moving.

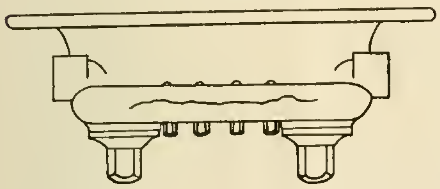
If the reversing valve is up, but we hear it drop as soon as we start to remove the reversing valve cap nut, the trouble is due to the reversing valve plate being partly or wholly disconnected. Sometimes when we find a reversing plate off, the reversing valve can be removed from the pump, but not always, as a shoulder wears on the shoulder of the reversing rod and prevents it being removed.

If, when shutting off the steam from the pump and attempting to remove the reversing valve cap nut, we hear the reversing valve drop, and upon examination we find we can only raise it a short distance, the trouble may be due to the bottom head off, or piston rod nuts partly or wholly off. We can readily ascertain if this is the cause by removing the plug in the lower cylinder head. While these are not all the defects that might occur in an air pump, they are the most common, and may be of some assistance to those of your readers who have this work to do.

John F. Long,
Roundhouse Repairman, Frisco Line.
Monett, Mo.

Cracked Pump Heads Repaired.

During the recent winter some of our New York pump heads were frozen up



MENDING A CRACKED PUMP HEAD

and became cracked in consequence thereof. These heads have been patched very efficiently and are in service at this time.

This was accomplished by first dressing off smoothly the lower side of steam passage and then screwing two or more ⅝ in. tap bolts, according to length of crack, through the two walls of this steam passage and drawing them up securely.

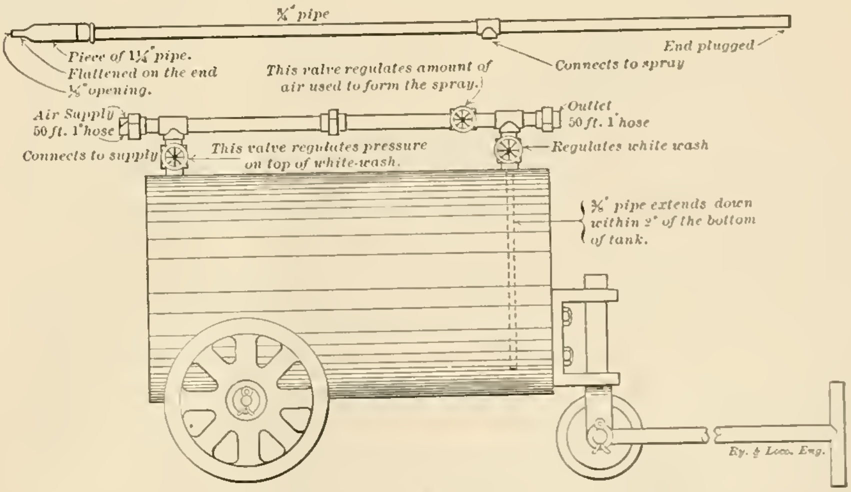
The attached sketch illustrates the worst one we have had, requiring four bolts to stop the leak.

E. O. Palmer.
Bloomington, Ill.

An Air Whitewasher.

Enclosed you will find sketch of an air whitewasher which beyond a doubt is a success in every sense of the word. Last year it required one man about one month to get same results that this whitewasher accomplished in less than two hours. I believe no explanation is necessary, as the cut is clear.

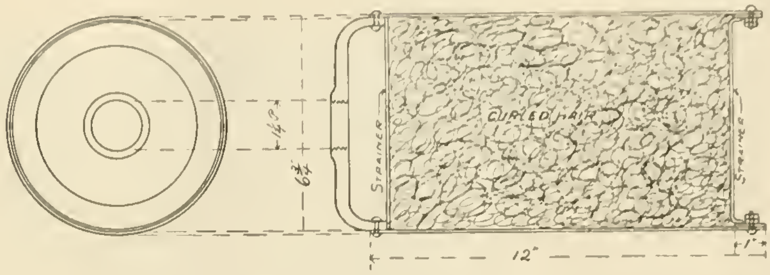
Henry W. James.
Toronto, Can.



AN INEXPENSIVE AIR WHITEWASHING MACHINE.

Air Pump Strainer.

The accompanying cut illustrates the strainer for the air cylinder of the air pump which we are using and have had



A SIMPLE DESIGN OF STRAINER FOR AIR PUMP.

good success with. As will be seen, the device consists of curled hair held between two strainers. The device is screwed on to the suction of air cylinder of the air pump and strains the dirt out of the air. The hair can be removed and cleaned with very little trouble.

John Hume, Jr.,
Genl. A. B. Inspr., H. & T. C. Ry.
Houston, Tex.

Engineer Moved to Left-Hand Side.

An order has recently been issued by the Northern Railway of France to built their locomotives so that the mecanicien, as the locomotive engineer is called in France, will stand on the left side of the engine instead of the right hand side, as was customary hitherto. The order for a change illustrates the conservative tendencies that prevail on foreign railways. Vehicles on common roads in Great Britain keep to the left when meeting other vehicles, but on the continent of Europe they follow the same practice customary in America, of keeping to the right. When railways were first introduced into Great Britain, trains were made to run keeping to the left following the practice of the common roads, and when the French railways began operating trains they first received the rolling stock from Great Britain, and imitated the British practice of running on the left side. An awkward arrangement in Great Britain was that the engine driver in early days was located on the right hand side of the engine, while the signals were on the left hand side, a very inconvenient and dangerous condition of affairs. Long ago the British railway companies changed their engines so that the man in charge was located on the side where he could see the signals most conveniently, but it has taken all these years for the French railroad companies to make the same common sense change.

New Orleans, 1905, Air Brake Association Proceedings.

The proceedings of the 1905, New Orleans, convention of the Air Brake Association, have just been finished and are on sale at this office, leather bound copy, $1.00, and paper bound, 75 cents. Order for your air brake file and library now, and don't wait until the edition is exhausted and out of print.

In the first part of this paper in the article on the 18-hour New York-Chicago trains we mention that the time of the New York Central & Lake Shore trains had been lengthened to 20 hours. The order to that effect was only a few days in operation, and the train is now running on the original schedule.

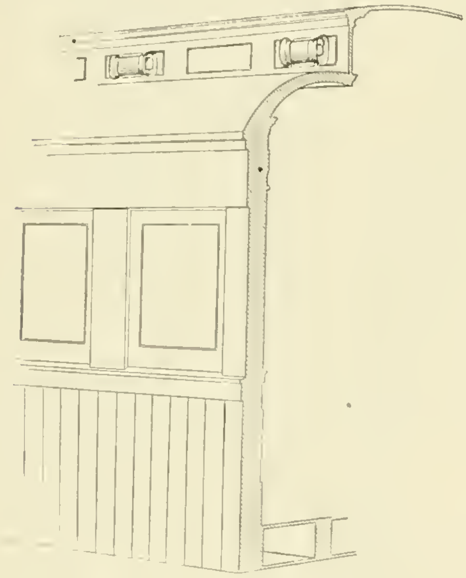
Ventilators for Passenger Car Equipment.

There has been such a demand for a positive ventilator for passenger car equipment, that the Safety Car Heating & Lighting Company has arranged for the manufacture and sale of an improved form of the Andrew Ventilator, which has heretofore been applied and is now in service on a considerable number of passenger coaches giving most satisfactory results.

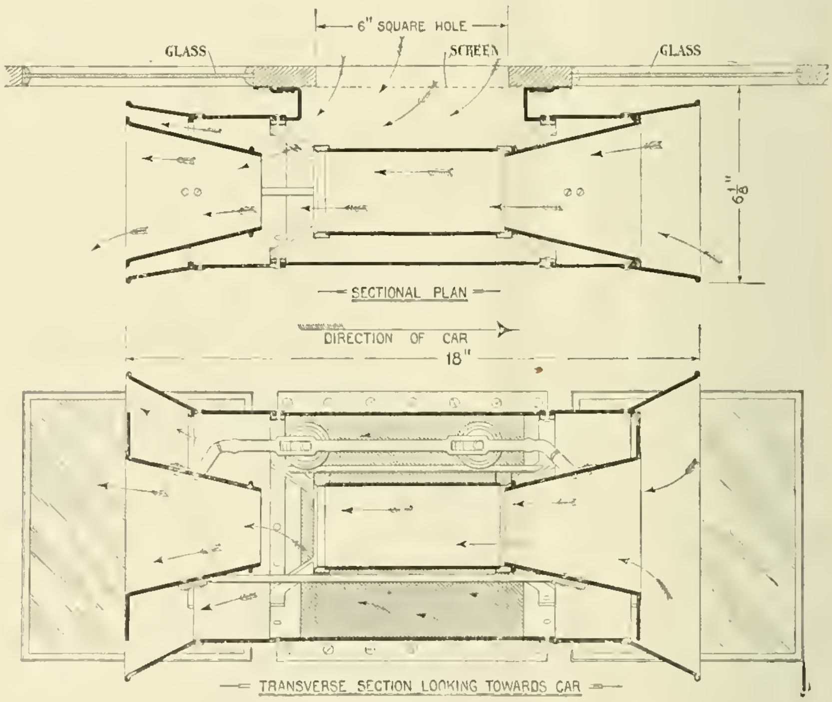
The ventilator which is designed for application to a portion of the deck sash openings of a car, is of the exhaust type; operates on the ejector principle, and is automatically reversible, accommodating itself in operation to the direction of the train without attention.

Fig. 1 shows in elevation its application to the side deck of a car. It is shown in sectional elevation in Fig. 2; in sectional plan in Fig. 3.

It is applied in connection with the deck sash openings, the screen being removed and a frame for the ventilator



SAFETY CAR HEATING. FIG. 1.



SAFETY CAR HEATING. FIGS. 2 & 3.

being substituted provided with glass, except for the 6-in. square screened opening for the ventilator connection. It is seen from this that the ventilators communicate directly with the interior of the car when the deck sash is open.

The deck sashes and their openings which are not fitted with ventilators need no alteration or attention—they may be opened for air supply or left closed.

It will be seen that the ventilator is storm-proof against transverse storms; that rain, snow, smoke and cinders striking it longitudinally are carried through the ventilator beyond the opening connecting with the car.

It will also be noticed that the reversal of the ventilators for changes in the direction of the motion of the car, is reduced to rolling friction—as a matter of fact, a speed of less than four miles per hour serves to reverse the ventilators.

Locomotives for Japan.

The Baldwin Locomotive Works have just received orders for 150 additional locomotives for the Imperial Government Railways of Japan, making 250 since the first of the year. Under the terms of the contracts, which were signed at Yokohama, all the locomotives are to be delivered there before December.

Within three weeks the last of the first 100 locomotives for Japan were shipped from Philadelphia, and the Minnesota, of the Great Northern Steamship Company, has just landed at Yokohama the first fifty-seven locomotives of that lot. The freight charge from Philadelphia across the United States by rail, and thence across the Pacific ocean by ship to Japan, is about $1,000 per locomotive.

Requiring promptly 200 more passenger locomotives of the type of those first ordered at Baldwin's, Japan asked for bids. The order was divided, 100 locomotives of this class being ordered from the Baldwin Locomotive Works and 100 from the North British Locomotive Company, the trust of Great Britain.

The Philadelphia concern could have had the entire lot, but let part of the business go, in order to take another contract covering fifty consolidated freight locomotives of the American type. These 150 locomotives will cost the Japanese Government about $1,500,000.

Compared with the giant locomotives used on railroads in this country, these passenger locomotives for Japan, where the gauge is 3½ ft., are small. They weigh 102,000 lbs., have a wheel base of 20 ft., driving wheels 49 ins. in diameter, and tanks holding 1,800 gallons of water.

The largest type passenger locomotive used in the United States weighs 225,000 lbs., has a wheel base of 35 ft., without the tender, driving wheels 84 ins. in diameter, and a tank capacity of 8,500 gallons. The 50 freight locomotives are to weigh 120,000 lbs. each.

The largest order ever placed for car journals has just been given to McCord & Co., of Chicago, for the equipment of the 10,000 freight cars ordered recently by the Baltimore & Ohio Railroad. Simplex truck bolsters have been specified for 9,950 cars, and Westinghouse draught gear for all cars except 250 refrigerator cars, the latter to have Miner draft gear.

It is reported that the Gould-Rockefeller interests have purchased a tract of land near Pueblo, Col., on which they intend erecting works for the building of locomotives and street cars.

The Renfroe Car Replacer Co. has been incorporated in Birmingham with a capital stock of $75,000. The company will establish a plant to manufacture a car replacer.

N. Y., Ontario & Western Roundhouse.

The illustration herewith shows a thoroughly up-to-date engine house recently built at Middletown, N. Y., for the New York, Ontario & Western Railway, according to plans prepared by Mr. C. E. Knickerbocker, engineer of maintenance of way for the company. In the cold climate of New York State an important feature of a roundhouse is the providing of heat at the right spot to thaw out frozen bearings and thereby get the engine ready quickly to go out again. This house is provided with the best heating and ventilating arrangement ever devised—that of B. F. Sturtevant & Co., Boston, and leaves nothing to be desired.

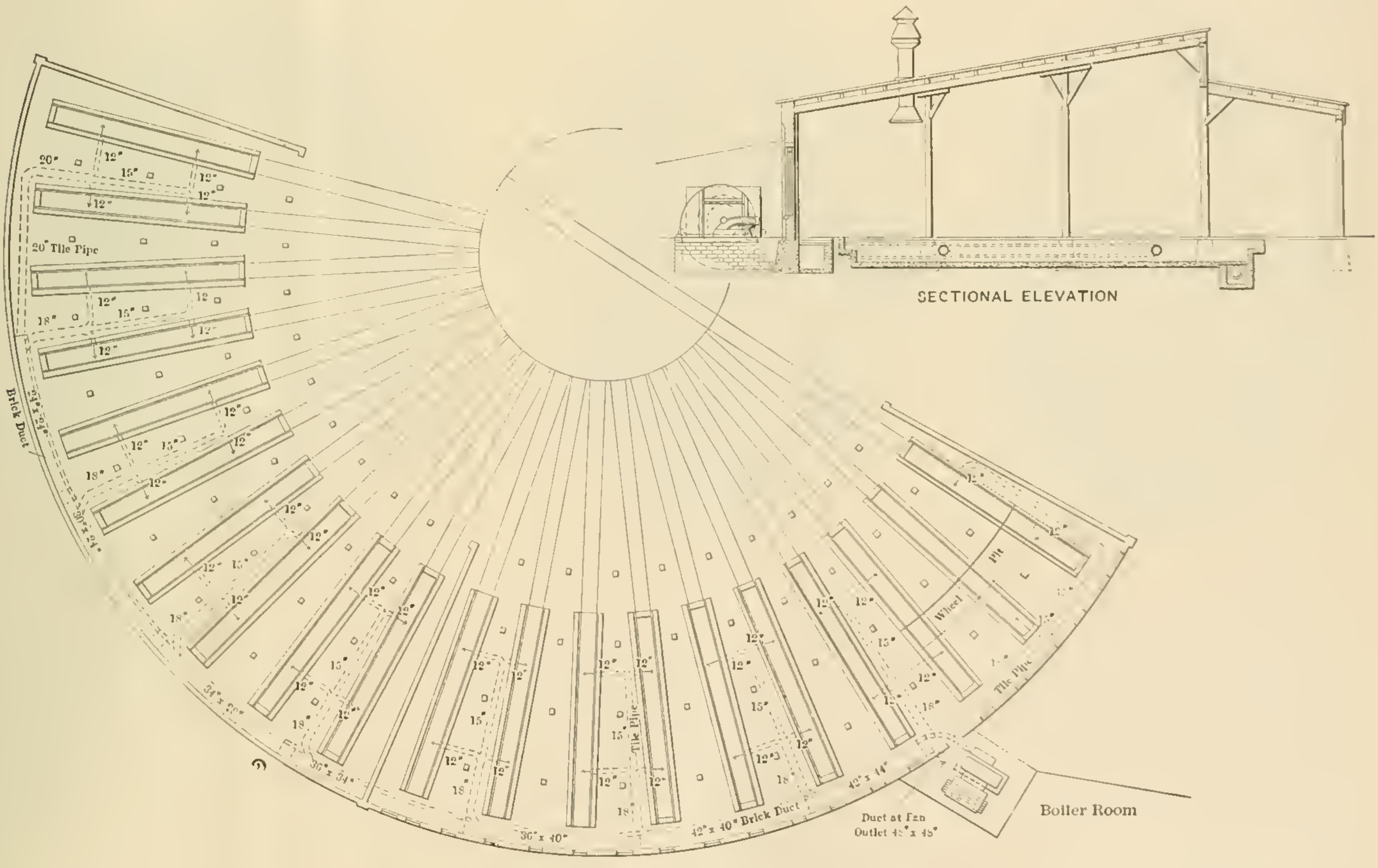
The building content is 646,760 cubic feet. The equipment consists of Sturtevant blast wheel, 7 ft. in diameter by 4 ft. in width, enclosed in 3/4 steel plate housing, with lower quarter extended beneath the floor and containing the outlet through which air is discharged into the underground duct. The fan is driven by 7x10½ direct connected engine, which draws the air through a Sturtevant heater containing 6,900 ft. of 1-in. pipe. The outfit was installed to heat the building to 65 degrees with temperature of zero outside.

It is stated that during the past winter the steam was furnished from an old engine which stood outside the house, as the new boilers could not be arranged and put in place at the time. The figures upon which the apparatus did the work last winter are, therefore, subject to change under altered conditions of equipment. It is reported, however, that the steam was held on the old engine at 130 lbs., and that nights during the winter when the thermometer was from 5 to 20 degrees below zero, engines coming into the house could be thawed out in from one to two hours, although completely covered with snow. In the old house, equipped with steam pipes in the pits, it is stated that it would take from five to six hours. It is claimed that the steam pipes placed in the pit are dangerous for the men, as they are liable to be burned and the pipes are apt to be broken from any old castings or material falling from the engines.

INSIDE OF NEW YORK, ONTARIO & WESTERN ROUNDHOUSE.

During a discussion on Locomotive Terminal Facilities at the Master Mechanics' Convention, Mr. George W. West, superintendent of motive power of the New York, Ontario & Western, said:

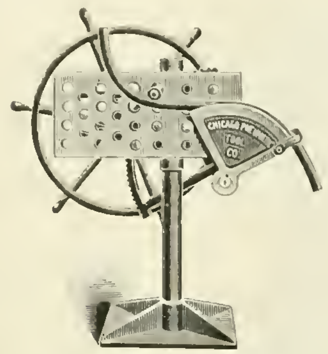
"In regard to the heating and ventilating of roundhouses, our company built a new roundhouse last fall, and all during the past winter, which was a very severe one, it was heated by the Sturtevant system of hot air. I must say that the roundhouse is a most comfortable place to work in, and was freer from smoke than any roundhouse I have ever been in. We had no trouble in removing the ice from the under side of the engine in one hour. The water would begin to drip from around the engine truck spokes in fifteen minutes after the engine came in. The air was all taken in, in the manner mentioned in the paper. We got all the air through port holes in the pits, and, as I have said, the roundhouse was very warm and very comfortable to work in, and the ventilation was perfect."



NEW YORK, ONTARIO & WESTERN ROUNDHOUSE.

Pneumatic Pipe Bending Machine.

The annexed engraving shows a pneumatic pipe bending apparatus that the Chicago Pneumatic Tool Company are



PIPE BENDING MACHINE.

putting upon the market. It will be noted that the machine is very simple in its construction, at the same time it will accomplish a marvelous complexity of work in line of its intended duty. Moreover, demanding the services of an ordinary helper only, who can, with the aid of this machine bend an amount of pipe to any desired complex curvature in one-tenth of the time that a skilled mechanic would require to perform the same amount of work with the aid of any device now used on the market, the value of the apparatus becomes at once self-evident.

Its light weight renders it extremely portable, thus enabling its being readily carried from shop to job, or vice versa, and can be secured to any column stanchion, or any available support in a few minutes, or a suitable stand can be furnished, as shown by the illustration.

Piping of steel, iron, brass, copper or other material can be bent cold up to 2 ins. diameter with one man. This device is indispensable in ship yards, pipe shops, locomotive works, sugar houses, and other places where pipe is used to any extent.

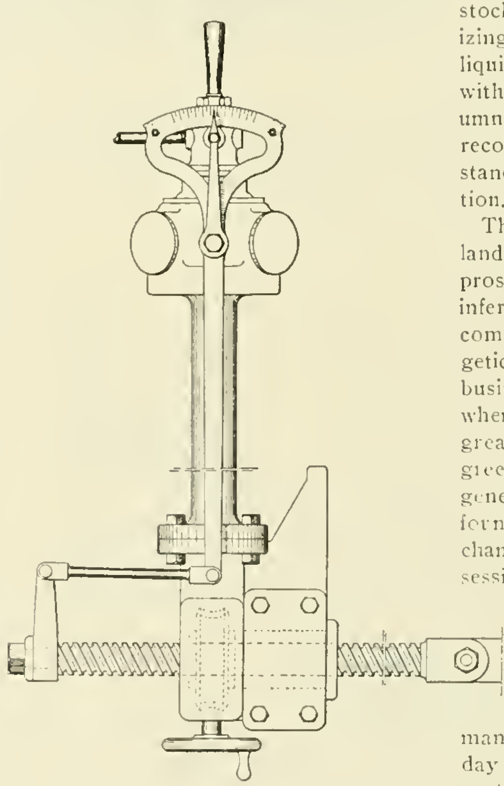
An instance of rapid locomotive repairing is reported from the Erie shops at Meadville. An engine was taken into the shops at 11 A. M. to have a broken cylinder replaced. The cylinders were replaced by ones taken from another engine, and the locomotive was ready for service within 25 hours from the time it entered the shops.

"Mogul" as a name for a locomotive appeals to the ordinary associated press reporter. When a railroad company introduces a new form of heavy passenger engine it is always denominated a "mogul" in the press dispatches.

The man who goes into a thing with a swelled head always comes out with a sore one.

Reversing Gear.

The engraving herewith illustrates a power reversing gear patented by Mr. W. J. McCarroll, and assigned to the Baldwin Locomotive Works. The gear is intended particularly for reversing the valve motion of locomotives, but it is not confined by the inventor to this application, as it may with suitable modification be used to operate a steering gear for vessels or any device requiring a reverse motion. It consists essentially of a vertical stem operated by the pistons of four cylinders arranged in opposing pairs, one pair being at right angles to the other. This stem carries a worm which gears with a worm-wheel which is threaded through the center to receive a screw, which is connected,



REVERSING GEAR.

if the gear is to be used in a locomotive, with the reach-rod, which is connected with the reversing link in the usual manner. A revolution of the stem will cause the worm to drive the worm wheel, which will cause the screw to travel in or out as the stem is driven forward or backward.

The claims of the invention are:

1. In a reversing gear, in combination, a reversing engine, a stem driven by said engine, a worm on said stem, an internally threaded worm wheel driven by said worm, a screw passing through and driven by said worm wheel adapted to be connected to a link, a pivoted arm carrying at one end a graduated arc and at the other connected to said screw, and stops carried by said arm adapted to engage and close the throttle valve by said reversing engine at a predetermined position of said screw.

2. The combination with a reversing engine, a link motion, and means operated by said engine for raising or lowering the link, of a pivoted arm carrying at one end a graduated scale and being at the other end attached to the link operating means, and a stationary pointer for indicating in connection with said scale the position of said link.

Another Locomotive Building Company Dead.

"The Taunton Locomotive Works corporation had its annual meeting on Wednesday afternoon, and after a thorough discussion of its affairs by the stockholders a vote was passed authorizing the directors to take steps to liquidate the concern. This is in line with the prediction made in these columns some days ago. The situation was recounted then and it is understood stands to-day in much the same condition."

The above item is from a New England paper. It is the requiem of a once prosperous concern that has died from inferior management. The Taunton Locomotive Works were started by energetic business men who forced their business into rapid success, at a time when New England manufacturers had great difficulties to overcome. By degrees the company became rich, but a generation later the strong blood of the founders began circulating through weak channels, the inheritors of a noble possession considered that it would always drift along giving out harvests without receiving fertilizers, and after a prolonged season of inanity the thing shrivels up. It is the history of many manufacturing concerns whose latter-day stockholders ought to have been sent to an asylum for the feeble minded.

The New York, New Haven & Hartford Railroad Co. have abolished the use of the trolley on the Port Chester branch of their road, and have introduced locomotives in their place. The engines are similar to those that used to operate the elevated railroads of various cities.

No book covers the subject of compound locomotives so well as the work by Mr. Fred H. Colvin. Any person can understand all about that type of engine by carefully reading this book. We do not know of any book so well worth one dollar. Send for it.

Charity is more than dropping a crust in the slot in the expectation of drawing out a three-layer cake.

Of Personal Interest.

Mr. George Gibbs, a few years ago the most popular railroad mechanical engineer in the country, was a very welcome visitor at the Railway Mechanical convention and had a busy time renewing old acquaintances. Mr. Gibbs drifted for his financial health into electrical railroad engineering and is one of the best authorities in the world on electric traction and mechanism. He has been for several years consulting engineer of the Interborough Rapid Transit Company, New York, a position he has recently left to become chief engineer of electric traction of the terminal operation of the Pennsylvania Railroad in New York, and also chief engineer of electric traction of the Long Island Railroad. Mr. Gibbs will also be consulting engineer of the Metropolitan Railway and will retain other influential engineering connections. We consider George Gibbs the most eminent engineer of all those who have risen through steam railroad channels and he thoroughly deserves the good fortune he has worked for.

GEORGE GIBBS.

Mr. R. H. Gray has been appointed master mechanic of the St. Louis & San Francisco.

Mr. E. H. Daniel has been appointed train master of the Central of Georgia at Columbus, Ga.

Mr. William Birchill has been appointed general foreman of the Detroit, Toledo & Iron, at Ironton, Ohio.

Mr. F. W. Cooper has been appointed master mechanic of the Lehigh Valley, with headquarters at Buffalo, N. Y.

Mr. W. F. Combs has been appointed master mechanic of the Macon, Dublin & Savannah, with headquarters at Macon, Ga.

Mr. Edward L. Douglass has been appointed general manager of the Gainesville Midland, with headquarters at Gainesville, Ga.

Mr. P. W. Nunan has been appointed trainmaster and car accountant of the Mississippi Central, with headquarters at Hattiesburg, Miss.

Mr. James M. Wisler has been appointed master mechanic of the Toledo Railway & Terminal Company, with office at Toledo, Ohio.

Mr. F. E. Sanborn has been appointed superintendent of the Portland division of the Maine Central, with office at Portland, Me.

Mr. D. D. Robertson has been appointed master mechanic of the Ft. Worth & Denver City, with headquarters at Childress, Tex.

E. A. MILLER.
Superintendent Motive Power, New York, Chicago and St. Louis. (Noticed last month.)

Mr. F. A. Beckert, general foreman of the Louisville & Nashville, has been appointed assistant master mechanic, with headquarters at Boyle's, Ala.

Mr. Charles Dunham, for several years signal engineer of the Illinois Central, has been appointed signal engineer of the Great Northern.

Mr. E. G. Bostwich has been appointed general foreman and traveling engineer of the Montana Railroad, with headquarters at Lombard, Mont.

Mr. H. V. Platt has been appointed superintendent of the Los Angeles division of the Southern Pacific, with headquarters at Los Angeles, Cal.

Mr. W. L. Kinsell, chief draughtsman of the Northern Pacific, has been promoted to the position of mechanical engineer, with office at St. Paul, Minn.

Mr. Fred Kirby, engineer on the Baltimore & Ohio, has been promoted to be air brake instructor and inspector of that road, with office at Baltimore, Md.

Mr. A. M. Phelan has been appointed master mechanic of the Spokane Falls & Northern, with headquarters at Northport, Wash., vice M. A. Nugent, resigned.

Mr. J. W. Thomas, for several years master mechanic on the Big Four, has been appointed master mechanic of the Panama Railroad, with headquarters at Colombia.

Mr. James T. Goodwin, the well-known foreman boiler maker of the Richmond Locomotive Works, has been elected president of the International Master Boiler Makers' Association. Mr. Goodwin is a graduate of the Illinois Central shops at Chicago, and worked for some time in the Rogers Locomotive Works before going to Richmond.

JAMES T. GOODWIN.

Mr. C. T. O'Neil has been appointed train master of the Pennsylvania Division of the Lehigh Valley, vice Mr. A. Ross, resigned. Mr. O'Neil's headquarters will be at Sayre, Pa.

Mr. T. J. Clayton, for some time traveling air brake inspector of the Kansas City Southern, has been appointed district locomotive foreman, with headquarters at Mena, Ark.

Mr. A. D'Heur, resident engineer of San Joaquin division, Southern Pacific

Company, has been appointed district engineer of the Southern District, with headquarters at Los Angeles.

Mr. C. V. Wood has been appointed superintendent of terminals, including the Rook Yard of the Wabash Pittsburgh Terminal Railway Company, with headquarters at Pittsburgh, Pa.

Mr. A. L. Moler, late master mechanic of the Chicago, Cincinnati & Louisville, has accepted the position of traveling engineer for the Locomotive Appliance Company, at Chicago.

Mr. R. H. Ingram, superintendent of Los Angeles division, Southern Pacific Company, has been appointed general superintendent of the Southern District, with headquarters at Los Angeles.

Mr. F. J. Easley, superintendent of the New Mexico Division of the Atchison, Topeka & Santa Fe, has been appointed superintendent of the Middle Division, with headquarters at Newton, Kan.

Mr. Nick Bowers has been appointed foreman, and Mr. John McGowan has been appointed assistant foreman of the shops of the Manistee & Grand Rapids, with headquarters at Filer City, Mich.

Mr. H. V. Platt, formerly of the Oregon Short Line, has been appointed division superintendent of Los Angeles division, with headquarters at Los Angeles, vice R. H. Ingram, promoted.

Mr. W. S. Galloway, formerly master mechanic of the Baltimore & Ohio, at Grafton, W. Va., has been appointed assistant purchasing agent of the same road, with headquarters at Baltimore, Md.

Mr. A. C. Hinckley has been appointed general master mechanic of the Cincinnati, Hamilton & Dayton, with headquarters at Lima, O. He was formerly a division master mechanic of the road.

Mr. R. H. Bowron, superintendent of the Northern and Southern Divisions of the Cincinnati, Hamilton & Dayton, has been appointed general manager of the same road, with headquarters at Cincinnati, Ohio.

Mr. J. P. O'Brien, general superintendent of the Oregon Railroad & Navigation Company, has been appointed vice-president and general manager of the same road, with headquarters at Portland, Ore.

Mr. O. S. Keith, formerly chief clerk to the general superintendent of transportation of the Illinois Central, has been appointed general superintendent of transportation of that road, with office at Chicago.

Mr. H. P. Latta, formerly master mechanic of the Toledo Railway & Terminal Company, has been appointed superintendent of motive power of the Mobile, Jackson & Kansas City, with headquarters at Mobile, Ala.

Mr. George R. Wadsworth has resigned his position of resident engineer on the New York Central Railroad to accept a position on the staff of J. G. White & Co. as assistant to the construction superintendent.

Mr. F. O. Melcher, general superintendent of the Choctaw district of the Rock Island system, has been advanced to the position of general manager of the Central and Northern districts, with headquarters at Chicago.

Mr. Thomas Paxton, formerly master mechanic of the El Paso & Southwestern, has been appointed superintendent of motive power of the same road, and also of the El Paso Northeastern system, with office at El Paso, Tex.

Mr. J. W. Patterson, Jr., having resigned as superintendent of the Wabash Terminal, the jurisdiction of Mr. H. W. McMaster has been extended over the Wabash Pittsburgh Terminal to Rook, with headquarters at Canton, Ohio.

Mr. D. K. Hamilton has been appointed sales agent of the Bethlehem Steel Company, of South Bethlehem, Pa. Mr. Hamilton will have charge of sales of railroad material, including locomotive forgings of all kinds, iron and steel castings and staybolt iron.

Mr. Rufus Hill, for many years master mechanic of the Pennsylvania Railroad, at Camden, N. J., has resigned, owing to the age limit of the company. Mr. Hill has witnessed nearly all the changes that added great lines to the Camden & Amboy which was the first link of what is now the Pennsylvania System.

Mr. H. T. Herr, who has been for a year or two assistant to Vice-President Schlacks, of the Denver & Rio Grande, has been appointed acting general superintendent of the road. Mr. Herr, who is a brother of E. M. Herr, of the Westinghouse Company, was formerly mechanical engineer and then master mechanic of the Norfolk & Western.

The division engineers of the Baltimore & Ohio will report to the assistant engineers, who in turn will report to the chief engineer. The department is under the jurisdiction of Mr. G. L. Potter, third vice-president, in charge of operation. The maintenance of way department is now in charge of ably educated expert engineers who will be able to keep up the efficiency to a high standard.

Mr. Thomas Fitzgerald, general manager of the Baltimore & Ohio, was entertained at a banquet at Fairmont, W. Va., lately. All Mr. Fitzgerald's experience has been on the Baltimore & Ohio, and he began work years ago as water boy with a track gang. We do not know of any railway official who is more popular with men under him than Mr. Fitzgerald, and his popularity extends to the highest patrons of the road.

Mr. James E. Hurley has been appointed general manager of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan. Mr. Hurley rose on the Santa Fe from brakeman up to his present position. He is a remarkably energetic man, and anything in railroad operating that he is not familiar with would be hard to find. His promotion has been very cordially received, especially by the trainmen of the road.

Mr. J. W. Daniels has been appointed superintendent of the Missouri Division of the St. Louis, Iron Mountain & Southern. Mr. Daniels will have jurisdiction in the transportation, maintenance of way and machinery departments, and will also have supervision of the transportation service of this company over the St. Louis Southwestern between Dexter and Illmo, Mo. Mr. Daniels' headquarters will be at De Soto, Mo.

During the International Railway Congress and at the Railway Mechanical convention we enjoyed pleasant visits from Mr. H. B. Howe, general works manager of the New South Wales Government Railway shops at Eveleigh. Mr. Howe has been a reader of RAILWAY AND LOCOMOTIVE ENGINEERING almost since it was started and he talks very cordially about the pleasure and benefit reading the paper affords him. He returns home about the time we go to press after a very extended tour among our shops and railways.

Within three months four members of the Marshall Pass Division of the Brotherhood of Locomotive Engineers have been promoted to official positions on the Denver & Rio Grande. They are, namely, E. G. Haskins, who has been promoted from the position of road foreman of engines to that of master mechanic; Mr. F. K. Martenis, promoted from engineer to be road foreman of engines; and Mr. J. O. Lasswell, promoted from engineer to the position of road foreman of engines of the second division. All have headquarters at Salida, Col.

Mr. T. E. Byrnes has been appointed inspector of transportation of the Missouri Pacific Railway Company. He will investigate the conditions surrounding train schedules, switching service and the arrangements for handling freight at local stations, junction points and terminals, and will in conjunction with representatives of the traffic department make recommendations for improvements in the service, as circumstances may require. He will also report upon the efficiency of the transportation service. Mr. Byrnes' offices will be at St. Louis, Mo., and he will report to the assistant general manager.

Mr. W. H. Dooley, who served his apprenticeship in the Erie shops at Jersey City, and was afterward roundhouse foreman at Bergen, leaving there to accept position as acting master mechanic with the Cincinnati, New Orleans & Texas Pacific, has been appointed general master mechanic of the same road, with headquarters at Birmingham, Ala. "Young Bill" Dooley was an ambitious young man, well liked by all who knew him, and one whose unceasing efforts have justly been crowded with success. It will be a pleasure to his old-time associates to read of his well earned promotion. May he continue to rise in the profession he has chosen.

The maintenance of way department of the Baltimore & Ohio Railroad has been reorganized, and Mr. J. B. Dickson given the higher title of chief engineer in charge, with headquarters at Baltimore. The territory of the Baltimore & Ohio System has been divided into three sections for the work of this department, and three new positions of engineer of maintenance of way created. Formerly Mr. Dickson was engineer of maintenance of way on the Baltimore & Ohio System. Mr. Dickson has been in railroad service for some time, starting with the Cleveland & Pittsburgh Railroad, and from there he went to the Chicago & Northwestern, and in January, 1902, he came to the Baltimore & Ohio as assistant engineer of maintenance of way.

Mr. H. E. Hale has been appointed engineer of maintenance of way of the Main Line System of the Baltimore & Ohio, with headquarters at Baltimore, Md.; Mr. H. H. Temple, engineer of the Pittsburgh System, with headquarters at Pittsburgh, and Mr. J. A. Spielman, engineer of the Wheeling System, with headquarters at Wheeling, W. Va. Mr. Hale was division engineer at Baltimore; Mr. Temple, division engineer at Pittsburgh, and Mr. Spielman was formerly superintendent of the Chicago division. Mr. V. H. Hendricks has been appointed division engineer, succeeding Mr. Hale, and Mr. L. P. Rossiter succeeds Mr. Temple as division engineer at Pittsburgh. Mr. Rossiter was assistant engineer of the Shenandoah division, with headquarters at Winchester, Va., and in that position he is succeeded by Mr. F. J. Batchelder. Mr. Hendricks was previously assistant to the engineer of maintenance of way.

Mr. R. W. Burnett, who was appointed assistant M. C. B. of the Erie in September last, has been promoted to be chief of the car department of the same road, with headquarters at Meadeville, Pa. Mr. Burnett was born in McLean county, Ill., in 1868. He entered railroad service in the car shops at Denver, Col., of the Union Pacific, in 1890. The following year he went to Chicago in the service of the Pittsburgh, Ft. Wayne & Chicago. In 1892 he was appointed foreman of the car department of the L. S. & M. S., and in August of the same year he was made general foreman of the car department at Chicago on that road. In 1899 he went to the Long Island Railroad as general foreman of the car department, with office at Richmond Hill. In 1900 he joined the service of the Central Railroad of New Jersey as general foreman at Elizabethport, which position he resigned to take service with the Erie.

Mr. Charles M. Hoffman has been appointed master mechanic on the Southern Railway, with headquarters at Princeton, Ind. Mr. Hoffman entered the service of the Kansas City, St. Joseph & Council Bluffs Railroad Co. as machinist apprentice at St. Joseph, Mo., July 1, 1887. After serving four years' apprenticeship he was appointed as shop foreman, which position he held until October, 1894. He then entered into the road service as fireman the latter part of October, 1894, and was promoted to engineer in September, 1898; from that position he was appointed night roundhouse foreman in November, 1900; promoted to day roundhouse foreman in 1902, and from day foreman to road foreman of engines, September, 1904, which position he held until leaving the service of the company to accept position as master mechanic of the Southern. Mr. Hoffman has been a very extensive traveler, visiting all large and modern shops in this country and Canada, keeping posted on all up-to-date and modern ways of railroading.

Official Changes in the Westinghouse Companies.

Mr. E. M. Herr, general manager of the Westinghouse Air Brake Co., resigns that position to accept the first vice-presidency of the Westinghouse Electric and Manufacturing Co. Mr. Herr retains his connection with the Air Brake Co. as third vice-president.

Mr. John F. Miller, secretary of the Westinghouse Air Brake Co., is elected to the fourth vice-presidency, and has general charge of the company's business.

Mr. A. L. Humphrey, Western manager, W. A. B. Co., becomes general manager, and assumes supervision of the company's manufacturing plants, and directs all work along mechanical and engineering lines. Mr. W. S. Bartholomew goes to Chicago, in place of Mr. Humphrey, and Mr. F. M. Nellis is transferred to Boston.

Erie's Steel Frame Box Cars.

The Erie now has in service a large number of steel underframe box cars which were built by the Standard Steel Car Company after their own plans. The under frames of these cars are similar in many respects to those which the builders have used for flat and gondola cars, consisting entirely of plates and commercial shapes. About 60 to 70 per cent. of the load is carried upon the center sills, which consist of flat plates thirty inches deep in the center and fifteen inches deep at the bolsters. To the top and bottom edges of these plates are riveted 5 by 4 inch angles, virtually forming an I-beam construction with a deep central section where the greatest strength is required. These sills extend a short distance beyond the body bolsters and are there spliced to the draft sills, which are channels. The side sills consist of channels with the flanges turned inward, which extend from bolster to bolster. The floor is carried by channel cross bearers, which extend between the center and side sills. These cars are of standard dimension for 80,000 pounds capacity, and have a light weight of 43,300 pounds.

One of the most important engineering problems waiting for solution to-day is a practicable method of using crude petroleum as the explosive in internal combustion engines. When this invention is perfected we will see gas engines driving the locomotives in all the regions where oil wells are to be found.

The story is told that a man traveling in one of the Trunk lines had his mouth cut through a sudden jerk given to the car while he was eating his lunch. He sued the company for damages, but the claim was defeated on the ground that it was a breach of etiquette for any person to put a knife in the mouth while eating.

We receive frequent complaints about coin being sent to pay for our educational charts not reaching its destination. Don't send coin in a letter. It presents too much of a temptation for petty thieving. Postage stamps are much safer.

A peculiarity about the Pullman Car Company is that while claiming the privileges of a common carrier, it repudiates the responsibilities of such a carrier when called upon to charge reasonable rates.

By patience and perseverance and a bottle of sweet oil, the snail at length reaches Jerusalem.—*Eastern Proverb.*

Train of Pressed Steel Cars.

The exhibit of the Pressed Steel Car Company, at Washington, D. C., in connection with the International Railway Congress, consisted of four (4) standard freight cars, including one box car, one flat car, and two gondola cars, as well as a pressed steel mine dump car, and various other pressed steel car specialties. The cars are the finest specimens of their class, and embody the very latest designs and appliances brought into use by the company in constructing its cars. Each of the four cars has a capacity of 100,000 lbs.

In addition to the four cars mentioned above, the Pressed Steel Car Company had also on exhibit their pressed steel mine dump car, which is a new departure in steel construction, as well as their Pressed Steel Fox Truck Frame, Pressed Steel Body and Truck Bolsters, Pressed Steel Brake Beam, Pressed Steel Side Stakes and Center Plates, together with a number of their model appliances for use in freight car construction.

The cars which the Pressed Steel Car Company exhibited at the International Railway Congress embody the use of almost every standard freight car appliance now in use, and were the finest ever sent by a railroad or construction company for exhibition purposes.

TRAIN OF PRESSED STEEL CARS.

In Touch With His Shopmen.

A most interesting talk was given by Mr. S. W. Miller, master mechanic of the Pennsylvania Lines at Columbus, at the Master Mechanics' Convention in discussing the Education of Railway Employees. Mr. Miller acknowledged having been a privileged special apprentice, but there are few men who have risen to take charge of shops who have displayed more sympathy with the needs, rights, troubles and grievances of workmen. Concerning shop matters he said:

I do not believe that we realize how the men feel about these things. I do not believe that it is generally appreciated that just as soon as a man is selected from the ranks and made a foreman there is an invisible barrier between him and the men who were formerly his shopmates. It is almost the same as if a brick wall had been built up between them. He does not associate with the men any more and frequently feels that he is somewhat better than they, and his wife will not call upon their wives, and his children will not walk to school with their children. As that goes up the line, and it gets to the general foreman or master mechanic, the wall becomes higher and it becomes thicker, and it becomes more difficult to discover just exactly how the men feel about things. I believe it is the most important duty of a master mechanic in charge of a shop to be fully in touch with his men and to know, not from hearsay or through the foreman, or any other outside source of information, but to learn from the men themselves personally how they feel about matters which are going on in the shop.

I have found it of the greatest assistance to me in my work to know the men personally. I had occasion the other day in thinking about this matter to count up how many of the men in the shop of which I am now master mechanic I personally knew—those whom I could call by name and whom I was in the habit of calling by their first name. We have 2,000 men, and I found that I knew slightly over 33 per cent. I do not feel that that is enough. I would like to know every one of them.

In thinking about the subject matter of this report it occurred to me that I would like to know how the men and the foreman feel about the special apprentice question, and I addressed a letter to 107 of the men and to the 92 assistant foremen and gang foremen whom we have, and asked them for their views, promising I would not make public their opinion, but wanted them to say exactly how they felt about it—their personal views. I assure you that the reading of the letters from these men was a treat to me. It shows me that the American mechanic of to-day, and not only the mechanic, because I addressed the letter to men in the labor gangs also, think about this apprentice system.

I am also free to say to you that the men believe that the master mechanic should know what is going on in the shop, and that everyone, without exception, says that the master mechanic should personally know as many men in the shop as it is possible for him to get acquainted with. I feel that the failure to do this is one of the reasons why we have troubles. We do not get close enough to the men. If each one of us had only 20 men to take care of, I guarantee there would be no necessity for trouble, because we would know what each man thought of certain things and be able to correct his views in the cases in which he was wrong, and we would also be able to show him our side of the question. We would make him understand that we were trying to do what was right for him, and trying to be fair and just to him; trying to advance his interests, and at the same time not prejudice those of the company; we would convince him that we were trying to make him a better man and a better citizen of these United States, and that we were desirous of doing everything, not only for our own personal interests, but for his, knowing that on the condition in which the man finds himself and on his desire to help his master mechanic or foreman the success of the master mechanic or foreman entirely depends.

Efficiency of Modern Locomotives.

Mr. Alvin B. Johnson, of the Baldwin Locomotive Works, recently made the following statement about the locomotives of this country:

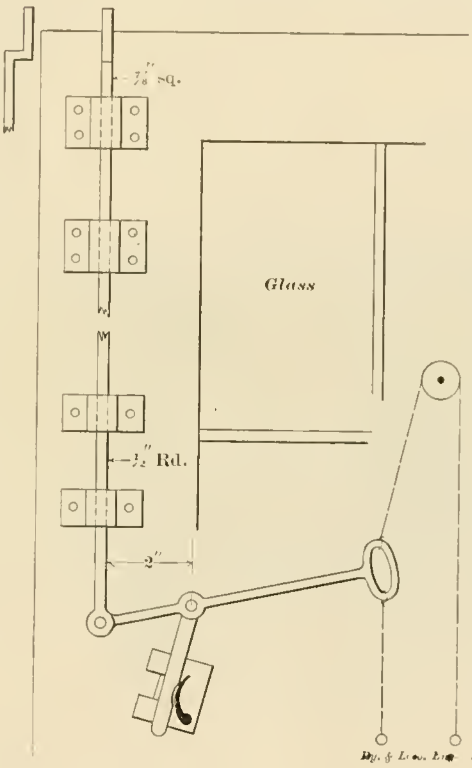
A locomotive is not subject to an annual reduction of efficiency. So long as its boiler is in condition to carry the pressure for which it was designed, and so long as the locomotive is maintained in a proper state of repair, it is capable of doing its maximum work. With the great improvements which have been made in boiler construction there should be no necessity for reducing the working pressure until the locomotive is, from other causes, about ready for withdrawal from service. There is not, therefore, an annual reduction of 10 per cent., nor of any other percentage, by reason of the depreciation of the efficiency of existing locomotives. The percentage of reduction of power caused by the retirement of old locomotives is much less than the ratio which the number of such locomotives bears to the whole number in service, because most of the locomotives now being withdrawn from service are light in weight and obsolete in type. Experience has shown that at intervals of about 20 years there come revolutionary changes in railway equipment. Thus we have seen the transition of carloads from 20,000 to 40,000, from 40,000 to 60,000 and from 60,000 to 100,000 lbs. capacity each, accompanied by corresponding changes in the weight of rail and in the capacity of locomotives. So certain is the further development of railway science that it is unsafe for any railroad manager to count upon the efficiency of the best known appliances for a period of more than 20 years in the future. Modern locomotives should maintain their maximum efficiency for at least 20 years, and should then be available for a good many years' service on branch lines. The depreciation is, therefore, less than 5 per cent, and instead of 4,600 locomotives being required annually to make good the depreciation in existing equipment, approximately 2,300 will be sufficient.

The locomotives now doing the greater portion of the work of the country have been constructed during the past ten years. They are of enormously greater capacity than those which they have replaced. Twenty years ago the heaviest standard freight locomotive had a weight on driving wheels of from 100,000 to 110,000 lbs. At present the average weight on driving wheels of heavy freight locomotives is about 180,000 lbs., an increase of fully 75 per cent.

One of the most conspicuous facts in railroad work during the past few years has been the vast sums spent in reducing grades, straightening curves and otherwise so improving the conditions of traffic as to reduce the power required for its movement. Such reduction of grades and curves is equivalent to a large increase in the effective capacity of locomotives, while the introduction of gravity yards also largely reduces switching engine mileage. It is difficult to convert this into the terms of a definite percentage of increased locomotive power, but it must be a very considerable factor both in increased efficiency and in reduced cost of operation, and tends to lessen the number of locomotives required for a given freight tonnage.

The average number of miles of track per locomotive for the whole country is approximately five, but this includes all of the old-established lines where traffic is concentrated and trains are numerous. Rarely do new roads provide themselves so liberally with power; one locomotive for each ten miles of track is nearer to the usual allowance. Therefore, 600 locomotives per annum should be sufficient to provide for new construction of 6,000 miles.

It is difficult to determine what number of locomotives is required annually to provide for increase of traffic, exclusive of renewals of existing equipment and equipment for new mileage. During the seven years from 1897, when the total number of locomotives in the country was 36,080, to 1904, when the total number of locomotives in the country was 44,529, the increase was 8,449, or an average of 1,207 per annum. This annual increase, of course, covered also



SHOP DOOR TOP LATCH.

new mileage and increased tonnage. It would be a liberal allowance to assume that 1,000 locomotives per annum are required for increasing tonnage.

Summarizing the foregoing, the total requirements of American railroads appear to be:

Number required for renewal of existing equipment	2,300
Number required for equipping new mileage	600
Assumed requirements for increasing annual tonnage	1,000
	3,900

During 1903 the American Locomotive Company built in its eight shops 2,216 locomotives, and the Baldwin Locomotive Works built in their shops in Philadelphia 2,022. Although having contracts sufficient to operate to their maximum capacity throughout that year, a number of causes contributed to prevent both concerns from realizing their maximum production. Both were engaged largely in rebuilding their shops, and both were greatly hampered during a considerable portion of the year by difficulties in obtaining supplies of materials. The Rogers Locomotive Works were operating as a third competitor, but their production was not made public. Since then the American Locomotive Company has acquired the Rogers Locomotive Works, and now advertises its capacity at 3,000 locomotives per annum. The Baldwin Locomotive Works are endeavoring to maintain a production of 50 locomotives per week. During March, 1905, they actually turned out 216 locomotives. It is, therefore, apparent that the combined capacity of these two concerns is approximately 5,500 locomotives per annum, or sufficient to renew the entire locomotive stock of the country each eight years. Not only is their capacity sufficient for all the needs of our American railroads, but, as appears from the foregoing, there exists a surplus capacity of something like 1,600 locomotives per annum out of which to provide for increasing future demands, for exports to foreign countries and for sales to those buyers whose purchases do not figure in the statistics.

Shop Door Top Latch.

A good shop door latch which is applicable to a roundhouse door and which when used is capable of keeping a door tight at the top, has been put in operation in the Pennsylvania repair shop at Wilmington, Del. It is made of ⅞ square iron at the top and is offset so as to give room for a substantial socket to be applied to the lintel above the door.

The square portion passes through two suitable guides and below, the rod is made of half-round iron which also slides in suitable guides so that the upward movement of the bolt, while quite free, is always in a straight line. The lever at the bottom is fastened at the pivot point from which hangs a short, flat rod which engages with a spring. When open or closed the bolt is held positively so that it will not shake down and requires hand power intentionally applied to move it. The lever is too high on the door, for this is the upper door bolt, to be readily grasped by a man, but two cords, one run over a small pulley, put the door latch within the reach of all. These cords are fastened to cleats so that they may be made fast, and so have everything in ship-shape order.

The wind cannot jamb this door or loosen it because it is bolted up snug at the top and requires a positive though light pull to release it. The latch, and, indeed the whole mechanism, can be modified by any one to suit requirements, but the idea remains the same—simple and effective.

Probably unless it was actually measured, it would be difficult to estimate the loss of heat during a hard winter which must take place in a roundhouse with doors agape an inch or two at the top, which, after the doors have warped, becomes what the testing department might call "permanent set," and in such cases the doors are never tightly closed. The top door bolt, easily made and readily worked, is a saver all the time, though it does not say much about it.

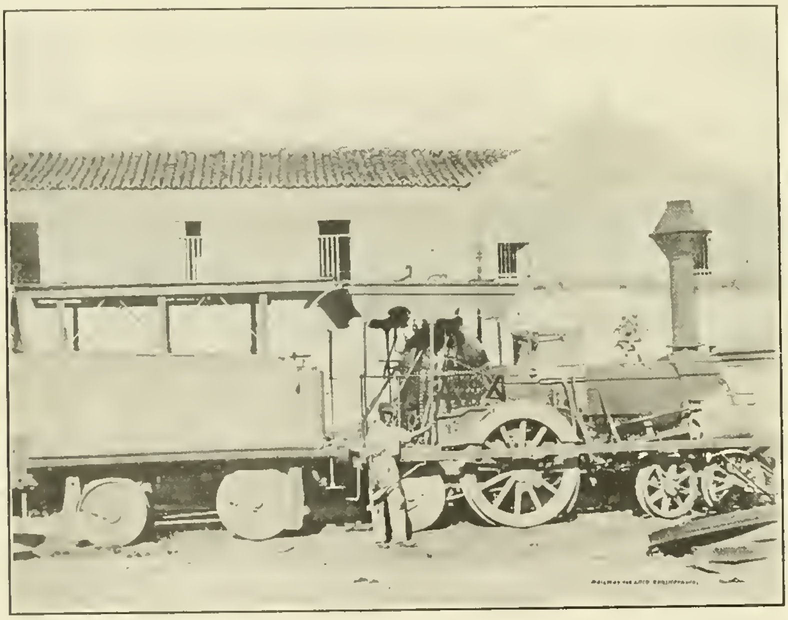
Heroic Greasing of Rails.

One of the funniest descriptions of rustic heroism that we have noted for some time has been recorded by the Sioux City *Tribune*. Here is the tale:

Not because he risked his life in performing a heroic deed, but for the reason that he showed superior presence of mind, does Tasker Henks, a farmer who lives south of town, deserve a share of the Carnegie hero fund. He was driving to town at full speed to bring a surgeon to his son, who had been injured by a rifle, when, on coming to the railroad crossing at the top of the Bently Hill, he saw that a railroad culvert had been burned beyond a sharp curve in the railroad track. Looking south he saw a freight train coming, far away across the Bently meadows. He had no time in which to wait to warn the train, for the boy at home was in a precarious condition. After a moment's thought Henks sprang out of his wagon and with a club killed his son's pet dog, that had followed the team. It was a fat dog, and cutting it up hastily he greased the tracks with it for several rods down the sharp grade south of the crossing and drove on his way on a gallop. On arriving at the greased grade the heavy train was stopped by the slipping of the wheels, and the trainmen, on looking for the cause, discovered the burned culvert. The surgeon soon got the boy out of all danger, and when the railroad officials learned how Mr. Henks had saved the train, they paid him $3 for the dog.

An Old Cuban.

The old Cuban locomotive illustrated in the annexed engraving, is one with an interesting history, if it could only be followed. The engine worked on Cuban railways for 59 years, from 1843 until 1902, when it was laid away for good.



EARLY ROGERS ENGINE THAT LONG FOUGHT AS CUBAN INSURGENT.

Probably the experience of the Nashville, Chattanooga & St. Louis engine Atlantic, which was stolen during the war, and is now preserved as a romantic relic, had a tame history beside the Cuban veteran.

This was one of the first outside connected engines built by Rogers, the first one having been the Stockbridge, built in 1842. All the engines of this type built were notorious for being slippery and most of them were later provided with a second pair of driving wheels in place of the trailers. There was no sand box originally, and the unsightly monster on the old boiler never was made in the Rogers Locomotive Works, which were always noted for elegance of design.

We are indebted to Mr. W. M. Stokes for the photograph from which the engraving was made.

Improving the Engine Shops of the Erie.

The Erie Railroad Company have suffered for years for want of housing capacity for their rolling stock, and for proper repairing facilities. President Underwood made a very careful inspection of the company's shops during a recent journey, and he determined to appropriate $1,500,000 for the purchase of tools and for improving their engine houses and repair shops. Nearly all the shops where repairs are carried on will be greatly improved.

In order to accommodate the new and heavier locomotives to be used, all the roundhouses are to be enlarged so as to give a uniform depth to the "stalls" of ninety-five feet, an average increase in depth of about ten feet. The new turntables to be installed at each roundhouse will be eighty feet in length, this enlargement being made necessary also by the increased size of the locomotives. New roundhouses of ten stalls each are to be built at Hammond, Ind., and Marion, Ohio, one of fifteen stalls at Port Jervis, one with fourteen stalls at Kent, Ohio, and one with six stalls at Bradford, Pa. Each house will be provided with new ash handling and coaling plants and enlarged cinder pits. Turntables are to be electrically operated in all of the yards, and yards and houses are to be lighted by electricity. The roundhouses, machine shops and other buildings to be erected are to be heated as a rule with a practical hot-air and ventilating system, and all appliances, whether for working purposes or for the comfort and convenience of the employees, are to be of the most modern kinds.

The Long Island Railroad is completing, in connection with the electrification of its western lines, a private telephone system, so that the superintendent at Long Island City can keep constantly in touch with all parts of the road. These road telephones will be scattered along the fifty miles of line, no two being more than 2,000 ft. apart. There will be about 150 of them, 100 being in special boxes similar to the police telephone boxes, and the rest in the switch towers and stations.

In his paper on Locomotives of Great Power, discussed at the International Railway Congress, Mr. J. E. Muhlfeld uses an expression about locomotive operating which will sound novel to railway men. He calls what we speak of as double-heading, "running locomotives tandem." The phrase is expressive and may be incorporated into our railroad vernacular.

Exhibits at the Master Mechanics' and Master Car Builders' Associations.

Following is the list of the exhibitors and articles exhibited in connection with the Manhattan Beach convention of the Master Mechanics' and Master Car Builders' Associations:

Acme White Lead & Color Works, Detroit, Mich.—Samples of paints, enamels and varnishes on woods and metals for interior and exterior use at stations, etc.

American Balance Valve Co., Jersey Shore, Pa.—A number of excellent models showing the construction and operation of the high pressure slide valve; external and internal admission of the J. F. Wilson high pressure type; also model of low pressure cylinder clearance valve; American semi-plug piston valve shown after a considerable term of service, and model of double and triple end piston valves.

American Brake Shoe & Foundry Co., Mahwah, N. J.—Several excellent types of steel backed brake shoes for high pressure passenger train service;

UNCONVENTIONALITIES.

also samples of brake shoes after a season's wear in hard freight service, showing how thin the brake shoes may be worn and used after the facing metal of the shoe has been broken.

American Steam Gauge and Valve Mfg. Co., Boston, Mass.—An excellent exhibit of locomotive steam gauges, air gauges, muffled and open locomotive pop safety valves; also the locomotive indicator, improved American-Thompson safety type.

American Steel Foundries, New York.—An extensive exhibit of cast steel locomotive frame, cast steel driving wheel center, simplex brake beam, simplex driving wheel and coach springs, simplex car and tender bolsters, cast steel and tender bolsters, cast steel side rods and cross heads; also the Leeds pilot couples and Janney all-steel M. C. B. coupler.

Andrews, J. S. & Co., New York.—A sample solid cast steel truck frame, Andrews' type, which is becoming so well known and highly appreciated.

Baldwin Locomotive Works, Philadelphia, Pa.—Track exhibit of Baldwin four-cylinder balanced compound locomotive, Pacific type, for the Oregon Railroad and Navigation Co.

Bethlehem Steel Co., Bethlehem, Pa.—A fine exhibit of the special high-grade staybolt iron manufactured by this company.

Bettendorf Axle Co., Davenport, Ia.—A convincing exhibit of the Bettendorf freight trucks, 30 and 40 tons capacity; also exhibit of passenger and freight tender trucks, passenger car truck, I-beam truck and body bolsters, I-beam truck frame, removable journal box truck frame, riveted arch bar truck frame, and cast steel center, still ends.

Bordo, L. J., Co., Philadelphia, Pa.—An exhibit of locomotive and stationary blow-off valves, hydraulic valves and swing joints, as applied between locomotives and tenders.

Bowser, L. S. & Co., Fort Wayne, Ind.—An exhibit of oil house equipments for railroads and factories, cabinets, shop tanks and underground gasoline storage.

Buda Foundry & Mfg. Co., Chicago, Ill.—An exhibit of car replacers, car and locomotive jacks, anti-friction metals and bronze for locomotive and car journal bearings. Also a line of anti-friction and bearing metals. Interest centers in their locomotive bronze. Tests show it to have great tensile strength and durability. It has been designed for driving box brasses, for driving rod brasses, eccentric straps, and for other bronze castings they recommend their "B" bronze. Their "C" bronze is designed to take the place of yellow brass. A line of ball bearing screw jacks was also shown.

Buffalo Brake Beam Co., Buffalo, N. Y.—An exhibit of brake beams of the well-known Vanderbilt type.

Butler Draw Attachment Co., Cleveland, Ohio.—An exhibition of the Butler draw bar, with the various attachments for passenger and freight equipment.

Camel Co., Chicago, Ill.—Car door fixtures, Hartman ball bearings, center plates and side bearings; also the Camel journal bearings.

Carborundum Co., Niagara Falls, N. Y.—An exhibition of a full line of carborundum goods, consisting of wheels, paper cloth, carborundum grains and other specialties, and carborundum fire sand for lining brass furnaces.

Carey, Philip, Mfg. Co., Cincinnati, Ohio.—An exhibition of building, roofing, plastic freight car roofing, locomotive boiler lagging, train pipe covering, magnesia and asbestos goods of all kinds.

Chicago Car Heating Co., Chicago, Ill.—An exhibition of the vapor system of car heating, and various modern and novel improvements in car heating specialties; also the standard heating system.

Chicago Pneumatic Tool Co., Chicago, Ill.—A fine exhibition of pneumatic hammers, drills, riveters, electric drills and pipe bending machines.

Cleveland Car Specialty Co., Cleveland, Ohio.—An exhibit of pressed steel carlines.

Cleveland City Forge and Iron Co.—An exhibit of turn buckles, draw bar yokes and general car forgings.

Cling Surface Co., Buffalo, N. Y.—A working model equipped with two belts, one untreated and running tight, and the other filled with the Cling Surface and running slack.

Commercial Acetylene Co., New York.—A working model showing the method of car lighting by acetylene gas.

Consolidated Car Heating Co., New York.—Extensive exhibit of steam car heating apparatus, including automatic steam couplers, automatic traps, extra heavy valves, fittings, etc.; also the McElroy automatic axle lighting system in actual operation.

Consolidated Railway Electric Lighting and Equipment Co., New York.—A motor-driven exhibit showing the system of lighting railway cars by electricity generated by the axle of the car, maintaining a constant current and voltage on the lamps.

Crandall Packing Co., Palmyra, N. Y.—An exhibit of air pump and throttle steam packing, and a line of general packings for cylinders, pumps, etc.

Crosby Steam Gauge and Valve Co., Boston, Mass.—An exhibit of locomotive gauges, pop safety valves, and spring seat, globe and angle valves, Johnstone blow-off cocks, air brake recorders, duplex air brake gauges, locomotive counters and revolution counters and engine indicators, Crosby original chime whistles, wheel press recorder and car heat gauges.

Davis, John, Co., Chicago, Ill.—An exhibit of steam specialties, air hose, couplings and flexible steam joints, back pressure valves and high pressure valves, steam whistles, Eclipse steam traps and blow-off valves.

Detroit Lubricator Co., Detroit, Mich.—An exhibit of new types of locomotive lubricators, types of three, four and five feeds.

Detroit Seamless Steel Tube Co., Detroit, Mich.—An exhibit of samples of locomotive flues, samples showing process of manufacture from the billet to the completed tube.

Dixon Crucible Co., Jersey City, N. J.—Dixon salica-graphite paint; also Dixon graphite lubricants.

Dressel Railway Lamp Works, New York.—This concern had a full line of headlights, switch and signal lamps, semaphore lamp, with fount for long burning, interchangeable classification lamp, steam and water gauge lamps and arc headlights.

Empire Safety Tread Co., Brooklyn, N. Y.—Carborundum safety treads applied to car steps, absolutely preventing slipping; railway station steps, carborundum buttons for vault light work.

Falls Hollow Staybolt Co., Cuyahoga Falls, O.—Hollow staybolt bars about 10 feet long, of different sizes; threaded bars bent flat without fracture; samples nicked and broken, showing fibrous fracture; also samples of raw material from which bars are made.

Flannery Bolt Company, Pittsburgh, Pa.—Staybolts for water space in locomotive boilers, showing flexibility of head and method of attachment.

Forsyth Bros. Co., Chicago, Ill.—Showed their radial draw bar centering device; also the Chaffee draw bar centering device, and safety deck sash ratchet.

Franklin Railway Supply Co., Frankline, Pa.—Franklin driving box lubricator was on view; also the Franklin pneumatic fire door opener, Franklin journal box, Franklin steam chest plug, McLaughlin flexible metal conduits, McLaughlin lock nuts, the Worthington coupler, and the Worthington emergency coupler.

Frost Railway Supply Co., Detroit, Mich.—Harvey friction draft spring and pressed steel specialties.

Garlock Packing Co., Palmyra, N. Y.—Fibrous packings for air pump and throttle were on exhibition; also hose and metallic packings.

General Electric Co., Schenectady, N. Y.—Curtis steam turbines, combination automatic straight air brake, compressor, automatic electric signals, moving pictures of electric locomotives, mercury arc rectifier, 500-kw. Curtis steam turbine bucket wheels.

Gold Car Heating & Lighting Co., New York.—Gold car heating and lighting apparatus, car heat regulators and fittings.

Gould Coupler Co., New York.—Electric car lighting system, foreign car coupler and application, Gould Z-beam steel platform for passenger cars, freight car steel couplers, friction buffer draft gear, journal boxes, steel bolsters for cars; also draft arms and friction draft gear, brake beam clamp, tandem draft gear for wood sill and steel cars, spring buffers and tender couplers.

Greene, Tweed & Co., New York.—Exhibit of Palmetto packing, together with the "Favorite" reversible ratchet wrench.

Harrison-Williams Company, Toledo, Ohio.—Harrison car journal lubricator of various sizes—5½x10 journals and boxes; also for the 5x9, the 4¼x8 and the 3¾x7 M. C. B. standard journals.

Helwig Mfg. Co., St. Paul, Minn.—Pneumatic Staybolt, clippers, reversible

(*Continued on page 340.*)

Master Mechanics' Proceedings.

(*Continued from page 302*)

THIRD SESSION.

The first technical subject discussed at this session was that of Water Softening for Locomotives. The paper stated in substance that there were two principal methods of softening feed water; namely, the continuous system, where there is a slow flow of water through slaked lime or soda ash permitting the scale forming material to settle, delivering continuously the purified water. A valuable adjunct to the continuous form is the filter, although it is quite expensive.

The other form, the intermittent form, allows the scale forming sediment to settle, when the pure water is pumped from the top without disturbing the sediment. This is regulated with respect to volume and must be practiced with considerable caution.

The paper stated that there were two classes of water, scale forming and alkaline, both being detrimental to boilers and tubes. The best treatment for removing the scale forming material was either by heating the water or by the use of chemicals. As yet no known process had been developed for removing alkaline materials, with the possible exception of distillation, which was admitted to be too expensive.

The report said "Your committee believes that the cost of purifying water for locomotive use is more than saved by the reduction in the labor cost of caring for boilers in the round house, and the benefit gained by freedom from leaky flues and poorly steaming engines on the road is all profit."

The next subject discussed was Time Service of Locomotives. The investigations made by the committee were made with a view to determine the time the engine is "in service, at terminals ready for service, and held for round-house repairs." The report stated that "The committee is of the opinion that such information will show that the greatest opportunities for increasing the mileage of the engines lies in reducing the delays in service and not in rushing them through round-houses more rapidly;" also, "It is reasonable to conclude that engines are ordinarily in the hands of, or at the disposal of the transportation department three-fourths of the time, and this department is responsible for the large proportion of delays which so materially limit the mileage at present obtained from locomotives."

On the subject of Shop Lay-Outs, Mr. Seley, the author of the paper, said that shops which more nearly approach the manufacturers' shop, where modern machinery, increased facilities and methods and greater volume were had, would, he believed, tend to keep engines longer out of the shop and result in higher revenue from their operation.

The discussion indicated that no set of specifications could be adopted to meet the requirements of all the characteristics of different railroads, and that each road must necessarily legislate for itself and its interests.

The subject of Locomotive Front Ends was taken up and after a short discussion relegated to the position which this much workedover subject has occupied for a number of years.

The subject of High Speed Steel was touched upon lightly with the result that all of the members seemed to fully value the merits of high speed steel, even though its cost was considered excessively high. Its superior performance was believed to warrant its general adoption in modern shops.

The paper on Mechanical Stokers was presented by Mr. Garstang, and was quite freely discussed with the general outcome that the device was a coming necessity for heavy locomotives and economical firing. Many requirements necessitated by the mechanical stoker had already been met by the manufacturers, but more were thought desirable, especially as past demands had been so easily met.

"Are Self Cleaning Front Ends Satisfactory?" was a subject presented for topical discussion by Mr. E. W. Pratt. The short discussion which followed indicated that self cleaning front ends were satisfactory and certainly desirable.

Mr. H. F. Ball, Superintendent Motive Power, L. S. & M. S., was elected President, William McIntosh, Second Vice-President, and H. H. Vaughan, Third Vice-President, and Angus Sinclair, Treasurer. Jos. W. Taylor was elected Secretary by the Executive Committee.

The convention adjourned.

The Master Car Builders' Convention.

OPENING SESSION.

President W. B. Appleyard called the meeting to order at 10 o'clock.

President Appleyard addressed the convention, reviewing the important events in close relation to the Association for the past year. He called attention to the rapid approach of general electrification of steam railroad lines, making special mention of the recent experiments made on the New York Central in this respect. He called attention to the necessity of further consideration being given to the friction draft gear which now seems to be coming into general use, and which promises to be generally adopted in the course of a very few years. He complimented the supply men on the able manner in which they had conducted the exhibition of railway devices at the International Railway Congress in May.

The reports of the Secretary and Treasurer showed the Association to be in a flourishing condition, having a membership of 607, and a balance in the treasury of $3,469.38.

The first subject disposed of was that of Triple Valve Tests. The committee's report stated that "It is probable that the coming year will require considerable work from the Triple Valve Committee, as there are some remarkably interesting developments taking place in that line, and if the new devices some of us have had the opportunity of seeing perform on the test track, prove as efficient in service, we may look for almost as much of a revolution of brake efficiency in the near future as there was when the automatic brake superceded the straight air brake. With this in view your committee would recommend the continuance of the Triple Valve Committee and that it be carefully selected to meet the prospective conditions. Its members so far as practicable should be skilled in air brake matters and instructed to confer with the Air Brake Association." The recommendations of the committee were adopted by the convention.

The committee on Brake Shoe Tests reported that three types of shoes had been presented to the committee for testing on the Purdue University machine. Nothing unexpected or unusual had been developed in these tests.

The report of the standing committee on Revision of Standards and Recommended Practices recommended that the distance from center to center of the brake heads of the brake beam should be reduced from 60½ ins. to 60 ins., as recommended by the Air Brake Men's Association last year. This was referred to letter ballot. Another recommendation was made that the brake lever proportions and total leverage of four wheel truck cars, be modified, as some objection had been found to these schedules. This matter was referred to a special committee to be appointed by the Executive Committee. Several other recommendations were made by the committee and adopted by the convention.

The committee on couplers recommended that larger rivets be used, combining the yoke with the coupler shank. The size and position of the holes for these rivets were also recommended to modification, and the committee's recommendations were adopted by the convention.

The convention adjourned to meet Tuesday morning at 9 o'clock.

SECOND SESSION.

The first subject introduced was that of Air Brake Hose. The committee recommended that an endeavor be made to produce a betetr hose at a lower cost. Laboratory tests had shown that the majority of burst hose was due to the neglect of railroads to follow the M. C. B. specifications, calling for the train pipe to be 13 inches from the center line of the car, and the angle cock to be turned inward at an angle of 30 degrees from a vertical line. The M. C. B. specifications remained practically the same as heretofore.

Secretary Moseley when called upon to give his opinion regarding train men stepping between cars, said that the automatic hose coupler had now been in service for a satisfactory experimental period, had already passed therefrom, and was now in practical service operation. He advised that one road was entirely equipped with it and that said road has experienced such satisfactory performance from it that undoubtedly many roads in the near future would be similarly equipped. He called attention to the fact that this device was much needed and was as surely a coming device as was the automotic air brake and the M. C. B. automotic car coupler.

The Arbitration Committee supported an appeal from a certain road asking that all air brake hose on foreign cars be made wrong repairs unless they met the M. C. B. specifications. This was made in view of the numerous wrecks recently due to burst hose. The committee recommended, and was supported by the convention, "that the charge for cleaning, oiling, testing and stenciling cylinders be increased to 30 cents," and that the item of "cleaning, testing and stenciling," under the head of details, be increased to 23 cents; also, that "the charge for triple valve, removed, cleaned, oiled, tested and stenciled be increased from 24 cents to 36 cents, the item of cleaning, testing and stenciling be increased from 6 cents to 18 cents, in order that the total charge may be made up." The committee was of the opinion that the amounts now allowed for this work were inadequate and should be increased to the figures named.

Mr. M. B. Curtis introduced as a topical discussion the standard height of platform from the rail, of Passenger Coaches. After some discussion the matter was referred to a special committee to be reported upon at next year's convention.

The convention adjourned to meet Wednesday morning at 9 o'clock.

CLOSING SESSION.

The third and last session of the Master Car Builders' Association opened with the discussion of the report on coupling chains, which subject was quickly finished. Then followed in order regular subjects on coupling chains, draft gear, cast iron wheels, doors, subjects, and unfinished business, each taking its allotted time in the discussion.

Considerable time was consumed in the discussion of the question of responsibility for the equipment lost by the railroads in the Kansas City flood. The Arbitration Committee's report was modified after a quite lengthy discussion, placing the responsibility for the lost cars on the railroads upon whose lines the cars were at the time that they were destroyed.

The topical discussion on Breakage of Flanges on Cast Iron Wheels and Greater Breaking Power for Freight Cars were finished after short discussions to the point. The election of officers resulted as follows:

President, Mr. Jos. Buker; First Vice-President, W. E. Fowler; Second Vice-President, Geo. N. Dow; Third Vice-President, R. F. McKenna; Treasurer, John Kirby.

The convention adjourned its final session.

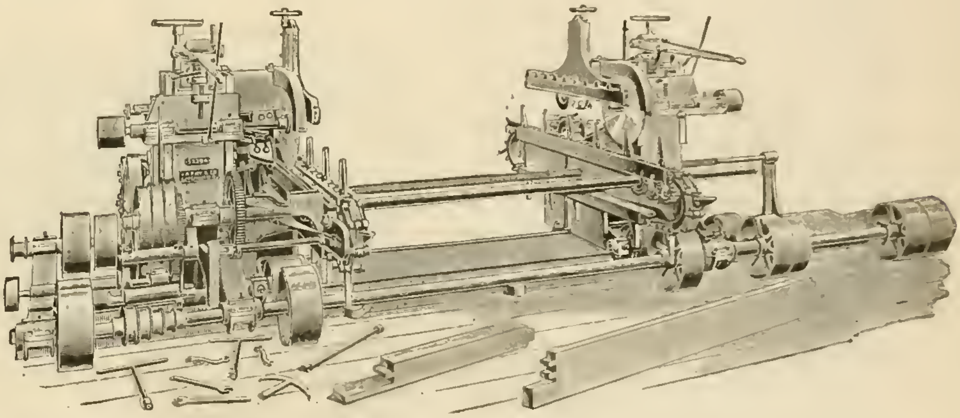
Automatic Double Car Tenoner.

In bringing out the new tenoner shown in our illustration, it has been the aim of the makers to have it as much of a labor saver as possible, and being entirely automatic, all responsibility is taken off the operator as to marking his stock. The machine cuts to exact lengths, and each piece comes from it accurately worked and with wonderful rapidity. The machine is invaluable where ends are cut separately, as the stock must then be turned around or over, and in either case the tenons at one end are likely to vary from those at the other. This tenoner was patented June 5, 1900. Limited space permits of only a brief description.

The machine will cut off and tenon material from 10 ins. to 9 ft. long between shoulders, and will cut off and tenon both ends of timber to 24 ins. wide and 8 ins. thick. By cutting off the lengths on some other machine, dispensing with the saws on this, timbers 12 ins. thick can be tenoned. Saws 22 ins. in diameter can be used, and, operating in advance of the cutter head, the bur raised by the saws is perfectly removed by the cutters, thus saving much valuable time. A special head is provided for making double tenons to 4 ins. deep.

There are eight tenoning heads, two on each spindle, and each carrying two knives cutting tenons 6 ins. long, so by using two heads on each spindle a tenon 12 ins. long can be cut. The machine is massive, built to stand hard work, and lots of it. The adjustments are made quickly and accurately.

The builders, the J. A. Fay & Egan Co., Cincinnati, Ohio, will be glad to send to those interested prices, cuts of machine and full information, and will also send their catalogue of woodworking machinery.



FAY & EGAN'S NO. 8 CAR TENONER.

The Tabor Indicator.

The Ashcroft Manufacturing Company have published a remarkably handsome illustrated catalogue of the old reliable Tabor indicator. Besides illustrating and describing this indicator and various attachments, the pamphlet gives valuable information for users of the instrument. The company, whose address is 85 Liberty street, New York, will send the catalogue free on application of people interested in steam engine indicators.

Bard Adjustable Bushing.

The Bard Adjustable Bushing, made by the Armstrong Manufacturing Company, of Bridgeport, Conn., has some new features which will recommend it at once to all users of bushings as well as to the trade in general.

This bushing is fitted with hardened jaws which are moved to and from center by means of a cam plate, and by fastening the plate with the thumb screw, the jaws are firmly held in any desired position.

The adjustable jaws make a perfect center for the pipe or rod, fit closely around the same and insure the cutting of a straight thread. When necessary a crooked or drunked thread can be cut with this bushing as easily as with a ring bushing.

When once attached to the die stock it can always remain there. It does away with the necessity of carrying a number of loose ring bushings, and saves the time now lost in hunting for, and changing the bushing for each size of pipe.

No more winding tin or paper around pipe or rod.

This adjustable bushing can be furnished to fit the Genuine Armstrong Stocks and Dies, Nos, 1, 2, 2½ and 3.

Liquid Refreshments for German Trains.

Several of the German governments have recently manifested great interest in catering to the stomachs of railroad passengers within their borders. In Germany, much more than here, refreshments are hawked alongside the passenger trains by waiters attached to the station restaurants, one of the most conspicuous attractions being huge mugs of foaming beer that can be carried along in the car and quaffed at leisure. It costs only a few cents and seduces many Americans away from strict prohibition habits.

Now the authorities in Saxony have ordered that these things must be included in the offerings:

Cool drinking water—for not more than 5 pfennigs (1.2 cents) a glass of 0.4 liter (the capacity of a small beer mug); mineral water for not more than 5 cents a small bottle, and fresh fruit in season, with the price plainly marked.

Bottles and glasses must be kept perfectly clean, and the provisions in the station buffets must be kept under glass to protect them from dust. Severe penalties are to be inflicted for violations of these rules.

Chicago Pneumatic Tool Company Captures European Orders.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, has returned from Europe where he has spent the last six weeks in the interest of the company.

He brought with him orders for 3,400 tools for shipment from America, representing a value of over $300,000.

Mr. Duntley states that the trip was the most successful he has ever experienced, and owing to the growing demand for pneumatic tools in England and on the the continent, it was found necessary to extend the organization of the foreign business. In order to accomplish this the factory and business of E. G. Eckstein, Berlin, Germany, and that of the Lencke Co., St. Petersburg, Russia, were purchased and will be operated for the purpose of meeting these requirements in the continental countries.

Pneumatic tools are rapidly being introduced in ship building and other large industries in Russia, Germany, Austria. Italy, France, etc., and a large increased demand for the various devices is anticipated. The line of electric drills exhibited and demonstrated was extremely successful, and large orders received therefor.

Owing to the fact that all European countries are well equipped with electricity, the electic drill is destined to rival the air drill in time and opens up a field, which heretofore could not be solicited. The profits earned through the extension of the foreign business will accrue to the benefit of the Chicago company.

The English courts of May 17, rendered the final adjudication of the patent litigation instituted by the English Company, which decision sustained all of the company's claims, 52 in number, covering pneumatic hammers, thus leaving the English company in a particularly strong position with reference to its patents.

Its plant, located at Fraserburgh, Scotland, is now in full operation. The American business, according to President Duntley, shows a very satisfactory increase in volume and all factories, both American and foreign, are operating overtime. The month of May was the largest month in the history of the company.

Pennsylvania's Electric Locomotives.

The Pennsylvania Railroad people have already begun to anticipate the work of building electric locomotives, which will have to be done to provide the Manhattan tunnels with power.

What is designed to be the most powerful electric locomotive in the world is now under construction in the Altoona shops. It will be used, with others of the same type, in carrying the heavy Pennsylvania passenger trains through the Manhattan tunnels.

This electric engine, designed under the direction of Chief of Motive Power Theodore N. Ely, and constructed under the eye of General Superintendent of Motive Power A. W. Gibbs, experts in electrical construction, will weigh something over 150 tons, be equipped with two articulated motors, similar to those on the electrics used in the Baltimore & Ohio tunnels at Baltimore, have two four-wheel trucks arranged for use with a third rail and be the most up-to-date electrical engine yet put together in this country.

A large contract for heating and ventilating equipment for the Elgin National Watch Co., Elgin, Ill., was recently awarded to B. F. Sturtevant Co., of Boston, Mass. This very extensive equipment consists of no less than five separate hot-blast apparatus, each including a fan, engine and heater, and also two special ventilating systems.

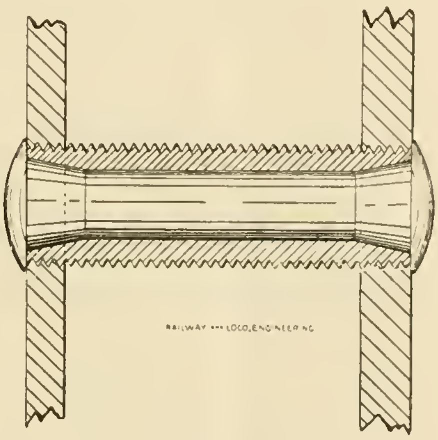
Men who have an evil habit to hide generally cache it away in an incubator.

New Form of Staybolt.

A novel form of staybolt has recently been patented by Mr. S. Dunning, which is shown in our illustration. It consists of a hollow staybolt with screw thread cut along its full length. The ends of this hollow bolt are countersunk where it passes through the fire box sheets.

The staybolt is completed by the insertion of a solid bolt having a head and countersunk neck at one end which fits one end of the hollow bolt. This solid core is made long enough to rivet over at the other end, the act of riveting at the same time upsetting the material so as to fill the countersunk portion of the hollow bolt, and causing the threads on the hollow portion to be forced tightly into the threads in the fire box sheets.

The object of the invention appears to be the combining of what is practically two staybolts in one, so that should one member become broken, the staybolt would not become entirely useless and in the event of the breakage of either no leak from the interior would take place.



DUNNING'S NEW FORM OF STAYBOLT.

Gas Storage on Sunken Yacht.

An interesting feature of the Commercial Acetylene Company's exhibit at the recent railway conventions was a picture of the wreck of the yacht *Vagabond*. This company's system had been installed and the boat was about to make her maiden trip when some gasoline was brought on board; a quantity of it was accidentally spilled. The fumes of the gasoline came in contact with an open coal fire in the galley, and explosions followed. The boat was set on fire and burned for some time, but was finally scuttled by the fire boats. She was submerged for four days. When the *Vagabond* was raised the photograph of which we speak was taken, showing that the safety storage system was uninjured, although the woodwork around the cylinders was charred. This practically constituted a most severe test. The storage cylinders first withstood tremendous heat, which caused expansion, and by being plunged into the cold water rapid contraction immediately followed. A test gauge was put on, and it was found that the pressure was the same as when the cylinders were installed. Had the gas been free in the cylinders they would not have withstood this severe test. The cylinders of this system are packed with asbestos saturated with acetone and charged with acetylene at ten atmospheres. Acetone is a chemical very similar to alcohol, and at ten atmospheres absorbs ten times its own volume of acetylene. When the pressure is removed it releases the gas.

In this system the regular railway cylinder, 20¼ ins. by 124 ins., contains 2,250 cu. ft. of acetylene. As a much smaller quantity of acetylene is necessary to get a given candle power, a railway cylinder will supply the ordinary coach with light for from two to three months. Several railroads are at present using the system, and it is also in use on vessels of all descriptions, including two United States revenue cutters.

New Factory for the Kennicott Co.

The Kennicott Water Softener Company has acquired several acres of ground at Chicago Heights, Ill., and is constructing thereon a new plant, the present quarters at Thirty-fifth and Butler streets, Chicago, having proved entirely inadequate to the needs of its constantly growing business. The new plant will consist of a main building 80 ft. wide by 300 ft. long, together with office buildings arranged for office, drafting room and laboratories, 40x46 ft., two stories high. The other buildings will consist of power house, 40x50 ft., and a machine shop 35x80 ft. The buildings will be of brick, steel and tile construction throughout.

The main building is to be equipped with a traveling crane of 80 ft. span, the crane being arranged to cover the entire area of the building, the roof of which is a single span, there being no posts. The yard space is to be covered with a traveling crane of 26 ft. span, erected upon steel posts. Provision is made in the main building for the entrance of cars, so that loading and unloading may be accomplished under cover. All tools are to be equipped with individual motor drive. Large purchases of machinery have been made to supplement the equipment already in use by the Kennicott Company.

Accomplished facts are hard coins; unrealized aspirations are promissory notes, which may never be cashed.—*Fothergill.*

Exhibits at Master Mechanics' and Master Car Builders' Conventions.

(*Continued from page 334.*)

pneumatic motors, pneumatic hammers, riveters, flue expanders, yoke riveters.

Holland Co., Chicago, Ill.—Dake compressed air motor in operation, the Martin flexible joints for pipe and Martin metallic conduit connection between engine and tender.

Homestead Valve Mfg. Co., Pittsburgh, Pa. — Locomotive blow-off valves, straightway valves, three-way and four-way valves; also patented steel tie.

International Correspondence Schools, Chicago and New York.—Exhibit of methods of instruction.

Jenkins Bros., New York.—A full line of regular and extra heavy brass and iron valves, various samples of "96" sheet packing, gasket tubing and pump valves.

Johns-Manville, H. W., Co., New York.—Asbestos and magnesia lagging for locomotives, pipe and boiler covering, train pipe covering, packings, asbestos fireproof lumber, smoke jackets, roofings, vulcabeston, refrigerator insulation, Kearsarge and asbestos packing.

Kennicott Water Softener Co., Chicago, Ill.—Large illuminated map showing the location of thêir apparatus on different railroads of this country.

Landis Machine Co., Waynesboro, Pa.—Nut tappers and pipe and bolt cutting machines.

Landis Tool Co., Waynesboro, Pa.—Samples of crank shafts and cutter grinding, No. 16 crank grinder, No. 3 universal grinder.

Lawrence Co., V. O., Philadelphia, Pa.—Filion vestibule trap on Long Island passenger car on track near hotel.

Martin Car Heating Co., Dunkirk, N. Y.—Couplers, valves, traps and steam specialties.

Mason Regulator Co., Boston, Mass.—The Mason locomotive reducing valve, regulators for steam, water or air; steam pump and damper regulator.

McConway & Torley Co., Pittsburgh, Pa.—Janney coupler, model of 1905; Kelso coupler, Pitt freight car coupler, Kelso tender coupler, Kelso pilot coupler, Janney passenger car coupler, Buhoup three-stem coupler with working model to demonstrate operation on curves; also an electrically operated pilot coupler.

McCord & Co., Chicago, Ill.—McCord journal boxes, draft gears, spring dampeners; also the McCanna force-feed lubricators, McKim gaskets and the well-known Gibraltar bumping post.

Metal Plated Car and Lumber Co., New York.—Brown metallic window strip.

Moran Flexible Joint Co., Louisville, Ky.—Metallic flexible joints for steam heat and air connection.

Nathan Mfg. Co., New York.—Exhibit of Freedman force feed lubricating pumps for locomotive valves and cylinders, used on engines equipped with superheating apparatus.

National Car Coupler Co., Chicago, Ill.—National steel platform and buffer for passenger cars, National freight car coupler, National centering yoke, Hinson draw bar attachment, Hinson draft gear, Hinson emergency knuckle; also the improved National passenger coupler No. 6; the passenger equipment was shown by a small working model.

National Malleable Castings Co., Cleveland, Ohio.—Exhibit of radial draft gear, pneumatically operated half-size cars for demonstrating working, Lower and Climax couplers and malleable castings.

New Jersey Tube Co., Newark, N. J.—A fine exhibit of corrugated boiler tubes.

Nichols, Geo. P., & Bro., Chicago, Ill.—Several illuminated transparencies and photographs illustrating electric transfer, turntables and drawbridge machinery.

Norton, A. O., Boston, Mass.—Ball-bearing lifting jacks of all kinds, journal, bridge jacks and various forms of track jacks.

Norton Grinding Co., Worcester, Mass.—Samples of work done by Norton grinding machines for railroad repair shop work; various shapes and sizes of grinding wheels.

Oliver Machinery Co., Grand Rapids, Mich.—An exhibit of wood-working machinery, such as saw benches, hand jointers, swing saws, band saws, wood face and gap lathes, disk sanders, wood trimmers and general pattern shop machinery.

Otley Manufacturing Co., Chicago, Ill. Eureka steam joint cement for locomotives, Eureka front end enamel for boiler fronts and for smoke jacks.

Pedrick & Ayer Co., Plainfield, N. J.—Portable repair tools for railroad repair shop work.

Pittsburgh Spring & Steel Co., Pittsburgh, Pa.—Locomotive driving springs, engine truck springs, tender and coach elliptic M. C. B. bolster and draft springs, coach equalizers, governor pop valves, release and various springs used in railroad and other work.

Pyle-National Electric Head Light Co., Chicago, Ill.—Exhibit of electric headlights for locomotives, turbine engine, electric lamps, electric generator, reflectors and cages.

Safety Car Heating & Lighting Co., New York.—Car lighting equipment by the incandescent mantle system in Long Island Railroad coach; also new ventilator. Their steam heating apparatus was also on view.

St. Louis Car Co., St. Louis, Mo.—Spiral journal bearings.

Sprague Electric Co., New York.—Electric hoists, steel armored steam and air hose; also flexible armored conduit and cables.

Standard Car Truck Co., Chocago, Ill.—Exhibit of the Barber car and locomotive trucks of from 50,000 to 150,000 lbs. capacity.

Standard Coupler Co., New York.—Standard steel platform and attachments; also Session-Standard friction draft gear.

Standard Paint Company, New York, N. Y.—Exhibit of Ruberoid locomotive roundhouse roofing on model running shed, and Ruberoid roofing for railway cars and locomotive cabs; also Ruberoid colored roofings, Giant insulating papers, flexible metal preservative paints, P. & B. and S. P. C. insulation.

Standard Pressed Steel Co., Philadelphia, Pa.—Exhibit of different styles of pressed steel shaft hangers, pillar blocks and brackets.

Standard Steel Works, Philadelphia, Pa.—Steel-tired wheels, springs, steel tires, solid rolled steel wheels.

Star Brass Mfg. Co., Boston, Mass.—Pop valves, new relief and vacuum valves, steam gauges, locomotive water gauges, outside spring indicators, "Siebert" sight feed lubricators and whistles.

Starrett, L. S., Co., Athol, Mass.—Hack saws, gauges, protractors and various handy shop tools.

Symington, T. H., Co., Baltimore, Md.—Journal boxes, engine truck box cellar, center and side ball bearings for railway cars.

Trojan Car Coupler Co., New York.—Junior couplers.

Universal Safety Tread Co., Boston, Mass.—Treads for station and car steps.

Vandyck, Churchill Co., New York.—Specimen of the Higley cold metal saw.

Victor Stoker Co., Cincinnati, O.—Victor locomotive stoker.

Walworth Mfg. Co., Boston, Mass.—Walworth locomotive injectors, stationary injectors, Walworth die plates and pipe cutters, taps and dies, Miller ratchet pipe cutters, Miller ratchet die plates, Walworth pipe vises, Stillson wrenches, Smith friction track drill, Smith sleeve and boiler ratchet drills.

Washburn Co., Minneapolis, Minn.—Washburn freight car, locomotive pilot and passenger car couplers.

Westinghouse Air Brake Co., Pittsburgh, Pa.—Showed a machine for indicating the capacity and operation of the Westinghouse friction draft gear; also a section of their draft gear; also a rack of sectional Westinghouse valves, triple valve testing rack (new engine and tender equipment), demonstrated by a rack equal to two locomotives and four cars; automatic air coupler, sectional 10-in. frieght equipment, 9½-in., 11-in. and compound air pumps, and a stand showing colored lithographic educational charts.

Westinghouse Air and Automatic Steam Coupler Co., St. Louis, Mo.—Westinghouse automatic air and steam couplers.

Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.—Exhibit of various electric motors.

Wheel Truing Brake Shoe Co., Detroit, Mich.—A full line of abrasive brake shoes for truing and dressing flat and worn wheels.

Williams, J. H., & Co., Brooklyn, N. Y.—Railroad forgings.

Woods Machine Co., S. A., Boston, Mass.—Chain mortiser and knife grinder.

Candidate for Railroad Commissioner.

Several divisions of the Brotherhood of Locomotive Engineers recommended Peter F. Keefe to Governor Higgins for appointment to the position of State Railroad Commissioner of New York. That is very good on the part of the brotherhoods, but Mr. Keefe lacks one qualification that will defeat the best efforts of his friends. He is not an accomplished wire-pulling politician. That is the requirement looked for in powerful candidates for the position of railroad commissioner. The law of New York requires the appointment of practical railroad men for the Railroad Commissioners, but most of the railroad experience of those holding the position has been gained riding in Pullman palace cars.

The Commercial Acetylene Company, of New York, received the contract to equip one of the new Erie steel postal cars with their safety storage system. The car was on exhibition at the recent International Railway Congress, held at Washington, D. C. In a former issue we credited another car lighting company with the equipment supplied by the Commercial Acetylene Co.

According to the newspaper cuttings we receive, there are more train accidents on the New York, New Haven & Hartford than on any railroad in the country. This is a strange condition of affairs in view of the fact that the system is equipped with block signals and all the most approved appliances for promoting the safe operation of trains.

Crane Company, Chicago, have found their business increased so much that they have had to erect a new office building at 519 South Canal street, Chicago. Removal was completed in June, and that is now the company's address.

The Pratt & Whitney Company, 111 Broadway, New York, have issued a yard of illustrated information concerning the work done by their thread cutting milling machines. It is a very effective way of illustrating what the machines will do.

Manning, Maxwell and Moore Incorporated.

An important event in the machinery trade was the incorporation, on May 31, of Manning, Maxwell & Moore, Incorporated, composed of the well-known house of Manning, Maxwell & Moore and its allied manufacturing companies, The Shaw Electrical Crane Co., The Ashcroft Manufacturing Co., The Consolidated Safety Valve Co., The Hayden & Derby Manufacturing Co., The Hancock Inspirator Co., and the United Injector Co.

The corporation was formed under the laws of the State of New Jersey, and is etsablishred on a basis which is unique among commercial enterprises of its kind, having a paid-up capital of five million dollars. There is but one kind of stock, known as common, non-assessable.

The officers of the new concern are: Charles A. Moore, President; John N. Derby, Vice-President; Martin Luscomb, Vice-President; Stephen B. Aller, Vice-President; Colby M. Chester, Jr., Treasurer; J. H. Blue, Assistant Treasurer; Charles Arthur Moore, Jr., Secretary, and Merle S. Clayton, Assistant Secretary.

There is to be a board of fifteen directors, among which are some very prominent New York business men. The present directors are: Charles A. Moore, John N. Derby, Charles A. Moore, Jr., Colby M. Chester, Jr., J. Rogers Maxwell, Edmund C. Converse, Martin Luscomb, Stephen B. Alled, Alfred Brotherhood, Robert A. Bole, John C. Emery, Jr., James B. Brady, P. M. Brotherhood and A. J. Babcock.

Business will be carried on at the home office of Manning, Maxwell & Moore, at 85, 87 and 89 Liberty street, New York, and through their branch offices in Boston, Philadelphia, Chicago, Cleveland, Pittsburgh and St. Louis.

The firm of Manning, Maxwell & Moore was established in 1881, composed of Henry S. Manning, Eugene L. Maxwell and Charles A. Moore. Mr. Maxwell died about ten years ago, and Mr. Moore recently purchased Mr. Manning's entire interest in the business.

The firm was remarkably successful from its inception, and has grown to be the largest concern of its kind in this country, if not in the world, while this combination just effected, with its ramifications and diversity of interests, is absolutely 'unparalleled in commercial history.

Of the several manufacturing companies involved in this consolidation, The Shaw Electric Crane Co., with works at Muskegon, Mich., are the manufacturers of the well-known Shaw electric traveling crane. The exhibit of this company received the grand prize at the Louisiana Purchase Exposition, and their works are the largest in the world devoted exclusively to the manufacture of electric traveling cranes.

The Ashcroft Manufacturing Co., whose works are located at Bridgeport, Conn., and whose business was established in 1851, are the largest manufacturers of steam gauges in the world. In addition to steam and pressure gauges, they manufacture the celebrated Tabor steam engine indicator, the Edson recording gauge and an extensive line of pipe fitters' tools. This company was awarded the grand prize at the St. Louis Exposition.

The Consolidated Safety Valve Co., whose works are also located in Bridgeport, are makers of the famous "Consolidated" safety valve, which is made under the original Richardson patents, and was the first successful "pop" safety valve ever produced.

The factory of The Hancock Inspirator Company is located in Boston, Mass. This business, established in 1876, consists of the manufacture of the Hancock inspirators for the feeding of locomotive, marine, stationary and portable boilers. Over 300,000 of these instruments are in daily use. This company also manufacture Hancock, globe, angle, 60-degree and cross valves, and are making a complete line of locomotive trimmings.

The business of The Hayden & Derby Manufacturing Co. was established in 1888, and they have a factory in Boston devoted to the manufacture of "Metropolitan" injectors, of which there are over 150,000 in use. They also make the "H-D" ejectors and other jet apparatus.

The Consolidated Safety Valve Co., The Hancock Inspirator Co., and The Hayden & Derby Manufacturing Co., all received gold medal awards for their exhibits at the St. Louis Exposition.

With the great prestige already gained by the firm and the various companies, reinforced by the energy, judgment and wide acquaintance of Mr. Moore and the efforts of the capable men with whom he has surrounded himself, the success of this new corporation seems to be well assured.

To Make Metals Everlasting.

The claim has been made that a Hungarian chemist has discovered a liquid chemical compound which he calls zerone, that prevents the oxidation of metals and other building materials, with the effect that they will be immune from the ravages of time. The inventor says that while traveling in Greece years ago he noticed that the mortar in stones of ruins which were over 2,000 years old had sustained no decay from the action of the weather. This led him to the conclusion that the building material had been subjected to a preserving process, and he secured specimens and proceeded to analyze the substances. This led to the discovery which he keeps a secret.

If the discovery is genuine it will be of immense value to railroad companies in the preservation of bridges, steel rails, steel cars and other parts that are subject to rapid decay from oxidation that no known coating can prevent. Public experiments with steel treated by the zerone process indicated that the metal resisted ammonia treatment to induce corrosion.

The information reaches us that a committee representing the railways and iron and steel industries of Germany are arranging to make thorough tests of the process.

The Walschaert Valve Motion.

The advantage usually claimed for the Walschaert valve gear, which has all the working parts outside, is that the motion is convenient to reach for examination and repairing. In a paper by Mr. J. E. Muhlfeld, discussed at the International Railway Congress, attention was directed to another advantage the radial valve gear has which is enabling the frames to be braced transversely near the axles, which cannot be done when eccentric and link connections are in the way.

Concerning the Walschaert valve motion, Mr. Muhlfeld said further:

"There are now several newly built locomotives in America which are equipped with the Walschaert motion gear. The chief difference between the Walschaert and the Stephenson motions is the constant lead with the former when the valve travel is changed and the combination of two distinct motions, one derived from a crank arm and the other from the crosshead. The Walschaert gear as originally designed was not symmetrical or in a vertical plane; there was a tendency to lateral bending and unequal wear, and when compared with the eccentric driven gear, it had the disadvantage of being affected by the vertical displacement of the axle. With improved designs these undesirable features have been appreciably overcome, and the simplicity, accessibility and operation of the Walschaert motion will insure its receiving due consideration for the steam distribution of modern tonnage and passenger locomotives.

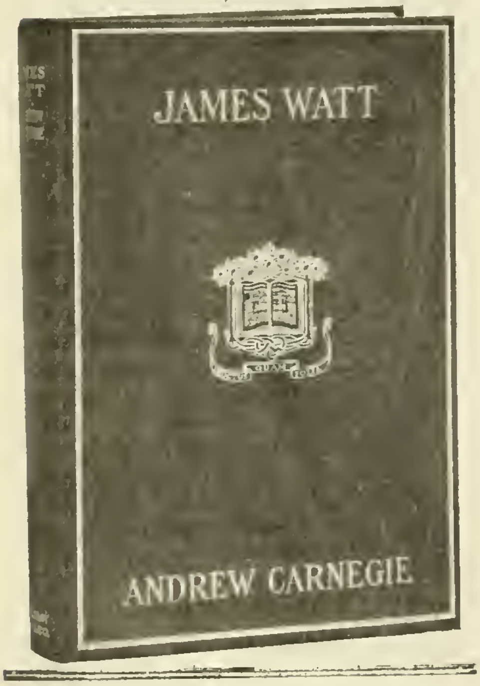
"When comparison is made between the weight of the moving parts and the size of the bearings of the Walschaert outside gear with similar parts of the Stephenson inside gear, it will be found that a simple design of the latter weighs more than double the amount of the former and is becoming a very cumbersome and heavy suspended reciprocating and revolving arrangement. The increased complication and weight of the Stephenson gear has resulted in a distorted steam distribution, to say nothing of the destructive effect of the heavy parts and the increased cost for maintenance on account of excessive wear and breakage. The eccentrics and straps have not only to carry the increased friction of the larger sizes of valves, but the reversing twice for every revolution and the inertia of the reciprocating parts of the gear, has contributed the principal load and they have become one of the troublesome details of locomotive machinery, requiring constant inspection and maintenance attention to prevent liability for heating or failure. Furthermore, the inaccessibility of the entire arrangement due to its location within the frames, makes proper attention almost impracticable in connection with the modern locomotive dispatchment conditions.

"A motion gear placed outside of the frames certainly has the advantage of accessibility and convenience for inspection, lubrication, repairs and cleaning, and the Walschaert type provides for this and gives an opportunity for better diagonal and cross bracing which is so necessary between the main frames and the frames and boilers to maintain alignment and stability and reduce frame failures.

"The Walschaert gear has long been popular in France, Germany, Belgium and other foreign countries, and it is used extensively on compound and simple types of locomotives for high and slow speeds. It can be made of comparatively light parts, and having no angular advance and no lead that can be given other than by the crank arm, a valve movement can be produced that is equivalent to that given by an eccentric having angular advance.

"Unless improvement can be effected in the design and application of the Stephenson motion, it will be necessary to inaugurate the use of the Walschaert or some similar type of gear for the modern locomotive construction in this country to insure the best results from high pressure with a single valve having large port openings and rapid movement for admission and exhaust, delayed opening of exhaust port for longer expansion and initial expansion and effective action on crank when the angularity of the main rod and piston pressure is most favorable to produce the greatest degree of efficiency as well as economy at high and low speeds."

The scheme recently introduced in the Alton roundhouse of using one set of men to wipe off the upper portion of the locomotives and another to look after the trucks and all portions below the running board has been found to work well.



Fay & Egan Building an Addition.

J. A. Fay & Egan Co., the large makers of wood working machinery, of Cincinnati, Ohio, are bound to clinch their claim of being the largest makers of this machinery in the world. They have found their business increasing at such a pace that it has been found impossible to fill their orders with their usual rapidity. This will now be remedied by a large five-story building that they now have under construction by their plant, having a space of about 50,000 sq. ft. It will be used as a shipping warehouse, and will serve to contain the finished machines ready for shipment, instead of, as heretofore, leaving the tools in the respective departments in which they are built. This will give them more room in all the departments and facilitate very much the shipping of their machinery. The warehouse will also serve as a showroom, so visitors having limited time may see the different tools all finished without having to go through all the factories.

In this connection it is not amiss to say that the Fay & Egan Co. could easily use double the space their shops now occupy, but limited land around that part of the city prevents their acquiring more property than the above mentioned lot.

The Baltimore Ball Bearing was used on a steel car belonging to the Monongahela Connecting Railroad which carried an average weight of 175,000 pounds. After being in use six months the bearing was taken out to form an exhibit at the railroad conventions. It displayed no evidence of wear, and the balls remained perfectly round.

The Consolidated Railway Electric Lighting and Equipment Company is building up quite a large and lucrative business in the sale of its "Axle Light" equipments of electric lights and fans for all kinds of railway passenger cars. The Consolidated "Axle Light," which is the trademark of this company, has become widely and favorably known both to railway officials and to travelers who appreciate the electric berth light and electric fans.

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Railway and Locomotive Engineering

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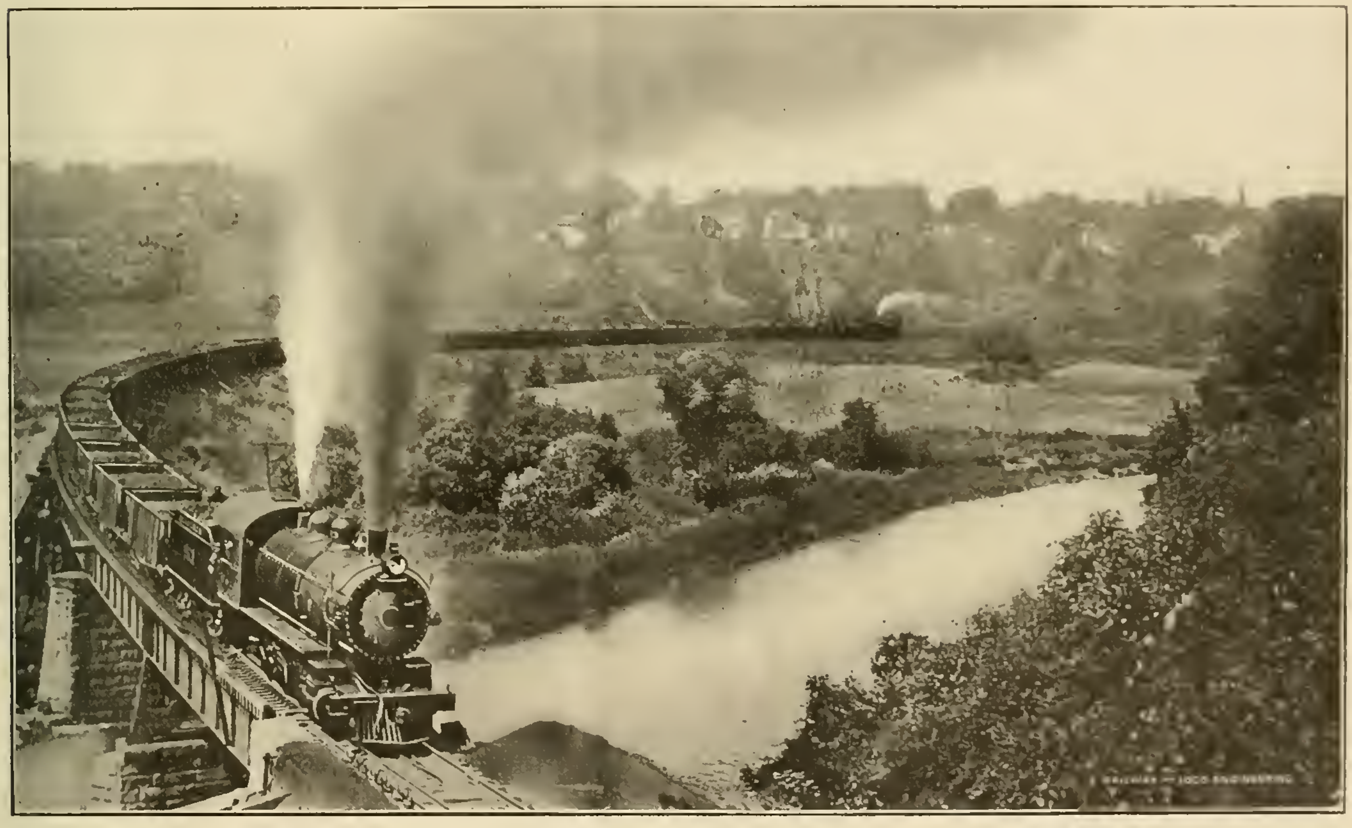
Heavy Work on the B. & L. E.

The frontispiece illustration of this issue of Railway and Locomotive Engineering shows an iron ore train leaving Conneaut, Ohio, on the Bessemer & Lake Erie Railroad. The view is of a heavy train made up of high-side gondolas loaded with ore and bound for the Pittsburgh district. The train is a long one and rounding the curve, engine 153 at the head end of the train, is giving a good account of herself, although assisted by a pusher at the far end.



SOLID TRAIN OF IRON ORE ON THE BESSEMER & LAKE ERIE BOUND FOR THE PITTSBURGH MILLS.

The Bessemer & Lake Erie have two ports on Lake Erie, viz., Conneaut, Ohio, and Erie, Pa. The latter place is the point where the Marquette & Bessemer Dock & Navigation Company's ferry boats bring ore across the lake from Port Stanley, and from Rondeau in Canada, and deliver it at Conneaut harbor in cars.

The Bessemer road handled 30,000 tons of ore a day last season, and since then improvements have been made which will enable it to double that amount. One hundred hopper cars of coal were hauled last year over the Youngstown branch of the Lake Shore, from Mahoning Valley to Ashtabula. This was then considered the limit, but this summer one hundred and ten have been tried.

Our illustration shows a typical American train of rough freight hauled in bulk from point of origin to destination. It is in handling this sort of bulk freight over long distances in cars having maximum load and minimum tare which helps to make our freight rates very reasonable, and in looking at this picture we can easily appreciate the disability our English cousins labor under in handling a freight traffic which in some respects resembles what we might be tempted to call a magnified express business.

Broken Journeys on Pioneer Railroads.

People who enjoy long uninterrupted journeys by rail in comfortable cars seldom realize the hardships of traveling by road and rail in times within the memory of old people still living. And the people who can now ride thousands of miles in comfortable cars without change or delay seldom realize the debt they owe to the men who carried out the patriotic labor of joining numerous broken ways into a continuous line from ocean to ocean.

In his address to the Railroad Young Men's Christian Association, Mr. William C. Brown, vice-president of the New York Central, gave an impressive picture of the inconveniences early railroad travelers had to endure and of the obstacles thrown in the way of remedies. Among other things, Mr. Brown said:

In 1850 the journey by rail from Albany to Buffalo, N. Y., a distance of 197 miles, required about eighteen hours, with four changes of cars and as many transfers of baggage from one depot to another. It was proposed to consolidate the several short lines of railroad into one continuous road over which through trains should run, eliminating the delay and annoyance of the several changes. Opposition, furious and determined, arose, and it took three years of continuous effort to bring about the desired result.

From Buffalo to Cleveland two changes were made, one at Dunkirk, the second at Erie; the proposition to consolidate the several pieces of railway into one, resulted in a conflict so bitter that the Erie war, so-called, ensued, in which the little city of Erie, from December 7, 1853, to February 1, 1854, was practically in the hands of a mob. Bridges were burned, the track was torn up, cars were turned over and destroyed. The press and the pulpit rang with denunciations of the proposed consolidation as a violation of the rights of the people and an aggregation of capital which was a menace to the perpetuity of our institutions.

In the light of the present, the utterances of that time, the editorials on the subject, sound intemperate and extreme beyond comprehension. It is a question whether or not some of the acts of State executives and legislatures and the editorial utterances upon the subject of these latter questions of expansion and consolidation will not seem as uncalled for and extreme a quarter of a century hence as were those upon a similar issue half a century ago.

It is unfortunately a fact that the decisions of some of our highest courts, in passing upon questions of this character, have sometimes seemed to reflect in some measure this popular clamor and opposition.

The first railroad bridge spanning the Mississippi river was built at Rock Island, Ill., and was completed in the latter part of April, 1856. Steamboat interests and citizens of St. Louis and other Mississippi river cities protested most emphatically against the construction of bridges across the river, and in May, 1858, one, James Ward, a citizen of St. Louis, filed a bill in the District Court of the United States for the District of Iowa, against the Bridge Company, setting out in detail the allegations of fact upon which it was claimed that the bridge was a nuisance and an obstruction to navigation, and praying that it be so adjudged and that it be "abated and removed," and "said river be restored to its original capacity for all purposes of navigation."

On the third day of April, 1860, the court adjudged that the bridge was "a material obstruction and a nuisance, and ordered the defendant to abate and remove all the said piers, together with the superstructure thereon, on or before the first day of October next."

Judge Love, of the District Court of the United States for the District of Iowa, stated the reasons on which this decree was based, and, as a matter of special historical interest, and to show that the courts are sometimes woefully mistaken, I quote these reasons in full:

"If one road transport passengers and freight to the East and West, without the expense and delay of changing at the river, a financial necessity will compel other competing roads to provide themselves with the same facilities in order to prevent their legitimate business from being attracted to the rival road. Thus already, in Iowa, preparations are being made to build bridges at Dubuque and Lyons. At McGregor and LaCrosse the same result will soon follow the same necessity. Next, at no distant day, we should probably have bridges at Muscatine, Burlington and St. Louis, not to mention other points where railroads will, in the course of time, cross the river. Thus, if this precedent be established, we shall probably in no great period of time have railroad bridges upon the Mississippi river at every forty or fifty miles of its course. Now, the upper Mississippi flows mainly through an open prairie country over which high winds prevail with great violence, especially in the spring, when trade is most active. From this cause it often happens, even now, that whole fleets of boats are compelled to lie for many days at a time at the upper and lower rapids, waiting for the high winds to subside. And we have seen that boats and rafts can rarely, in the night, with safety, venture into the draw of a bridge in the strong current of so great a river. What, then, would be the future consequence of bridging this river at short intervals when in the course of events the commerce floating upon it shall have increased until it will surpass in amount and grandeur all that ever entered into the most extravagant calculations of the economist—all the dreaming enthusiast ever saw in glowing and splendid vision? Therefore, although I am deeply sensible of the vast pecuniary sacrifice involved in the removal of this bridge, yet I consider it trifling compared to the great mischief which must inevitably flow from the precedent of maintaining it. Moreover, I can but remember that the free and unmolested navigation of the Mississippi was a vested right in the citizen, before the defendant, with, as I think, a very doubtful authority of law, rashly expended his money in the building of the bridge. This vested right no corporation or individual can justifiably impair under pretext of conferring upon the public some compensating advantage, and the defendant having assumed to do so must suffer instead of those whose rights have been invaded."

An appeal was taken to the Supreme Court of the United States, and, pending the decision of this appeal, repeated attempts were made to burn the bridge, and two employees of the Chamber of Commerce of St. Louis were arrested in Davenport, Iowa, on the charge of conspiracy to accomplish the destruction of the bridge by fire. The testimony submitted on the trial of this case was contradictory and the jury returned a verdict of "Not guilty."

The final decision of the great question of the right to maintain this bridge or to construct others reversed the decision of Judge Love, but was by a divided bench. In dissenting from the opinion of the majority, Justice Nelson said:

"The right to a free and unobstructed navigation of this river on the part of the public, and especially of the citizens of the United States, depends upon the Constitution and the laws of the United States, the public law of the country. The local laws of the States have no control over it. I speak now of the free and unobstructed navigation of the river, and according to the general public law the right of navigation extends over every part of the space between the banks."

In this opinion, which would have made bridges across either the Mississippi or Missouri rivers an absolute impossibility, Justices Wayne and Clifford concurred.

In the trial of this great issue, the importance of which the participants could have had but meager conception, Abraham Lincoln was of counsel for the Bridge Company, and to his argument, to his clear-sighted, exalted perception of the great future of the vast Trans-Mississippi empire, we are indebted for the reversal of a decision which, had it been affirmed by the higher court, would have checked the growth and prosperity of the West almost beyond belief or expression.

Mr. Lincoln admitted that the bridge was an obstruction, but claimed that it was not an unreasonable obstruction, that the river and the railroads were great highways for the people, and that the people who traveled by the latter were entitled to equal consideration with those who traveled by river.

In closing, he ventured the prediction that the time would come in the growth and development of the great West when the number of passengers crossing the river would equal and perhaps exceed those traveling up and down the river in boats.

The masterful argument of Mr. Lincoln forced into the consideration of the great issue the question of the reasonableness of the obstruction, and by legislative amendment or by judicial interpretation the question of reasonable restraint of commerce as against any restraint whatever, must become a part of the national law and must be considered in its enforcement, or obstacles to commercial and industrial progress are likely to be interposed, the gravity of which no one can foresee and only the lapse of years determine.

In a paper read by Charles E. Yetman, at the New York Railroad Club, on The Evolution of the Telegraph in Railroad Work, surprise was expressed that no improvement had been made on the Morse telegraph instrument key since it was first brought out. That is a very great compliment to the inventive genius of Morse, for he appears to have devised a perfect key when the telegraph instrument was first designed.

Pacific Type Engine Built at Lima.

Some engines of the 2-6-2 type have recently been built by the Lima Locomotive & Machine Company, of Lima, Ohio, for the Red River & Gulf Railway.

. . . . .

The engine is a simple one, which has been arranged to burn coal and wood. The cylinders are 15x20 ins. and the driving wheels are 46 ins. in diameter. The main driving wheels are not flanged, but the front and back drivers are. The face of the unflanged wheel tires measures 6 ins. wide. The main valves of these engines are balanced slide valves, and they have a travel of 4½ ins. The lead in full gear is 1/16 of an inch, and the lap is ¾ of an inch. The valve motion is indirect and the links are placed ahead of the rocker box, and give motion to the rocker arm by means of a transmission bar. This bar is suspended by a hanger in front of the link, and the link block pin is about midway between hanger and rocker arm.

The engine is built to round sharp curves, the gauge of the track being 4 ft. 8½ ins. The rigid wheel base is 9 ft. 2 ins. The front and rear trucks are radial with cast iron steel frames, and three-point cast steel hangers. The total engine wheel base is 23 ft. 9 ins., while that of the engine and tender is 47 ft. 2 ins. The weight of the engine alone is 60,800 lbs., of which the drivers carry 23,000 lbs. The weight of the engine and tender in working order is 149,400 lbs.

The straight-top boiler used has a diameter of 49⅜ ins. at the smoke box end. The tubes are 148 in number and are each 11 ft. 10½ ins. long. The total heating surface is 994.1 sq. ft., made up of 75.6 sq. ft. from the fire box and 918.5 from the tubes. The grate area is 14.12 sq. ft. The steam pressure is 180 lbs.

The tender is carried on a frame made of 9 in. steel channels, with wrought iron and steel body bolsters. Diamond trucks are used, with cast steel bolsters and channel spring planks. The capacity of the tank is 3,000 U. S. gallons. The engine is equipped with Detroit sight feed lubricators, Ashcroft steam gauges and No. 8 Monitor injectors.

Some of the principal dimensions are as follows:

Engine Truck Wheels—26 ins.; journals, 4½x6½ ins. Rear end main rod forked style. Parallel rods with solid ends and bronze bushings. All oil cups forged solid on rods.

Boiler—Shell, ½ in.; throat, 9/16 in.; front tube sheet, ½ in.; fire box tube sheet, ½ in.; door sheet, ⅝ in.; crown and sides, ⅝ in.; mud ring, 3¼ ins. deep, double riveted; 1⅛ in. radial stays. Longitudinal seams butt joint; circumferential seams double riveted.

Fire Box—59 3/16 ins. long by 34⅝ ins. wide at grates; 59 9/16 ins. deep at front and 57 9/16 ins. at rear; rocking grates with front and rear dead plates are used.

Tender—¼ in. steel plates; 30 in. truck wheels and 4¼x8 in. journals.

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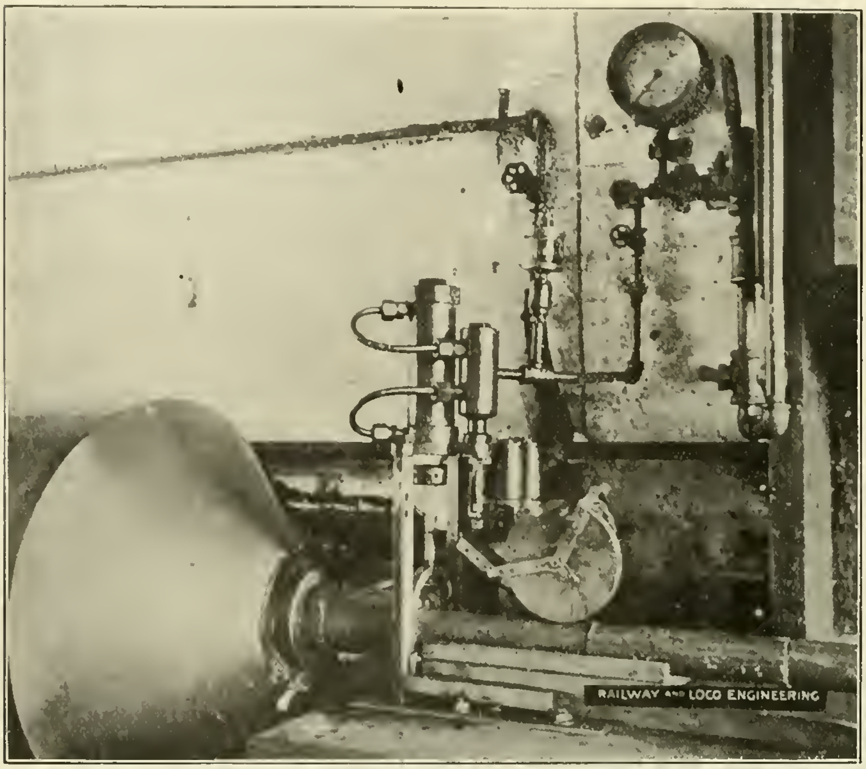
PACIFIC TYPE ENGINE BUILT FOR THE RED RIVER & GULF RAILWAY.

Grease Plant, C. & N.-W. Ry.

With the foresight characteristic of Mr. Robert Quayle, superintendent of motive power of the Chicago & North-Western Railway, what may be called a rod grease plant capable of supplying the entire system has been established at Clinton, Iowa. To Mr. F. G. Benjamin, master mechanic at that point, fell the task of devising machinery to economically and expeditiously handle the output, and the results obtained have been most satisfactory. The tallow vat is a rectangular vessel 24x24x38½ ins., made of 20 B. W. G. galvanized iron. A ¾-in. steam pipe enters the vat from the top and terminates in a coil at the bottom. By this arrangement it is possible to heat the tallow to any desired temperature without danger of burning it.



ROD CUP GREASE MACHINE, CHICAGO & NORTH-WESTERN RAILWAY.

The lye vat, cylindrical in shape, has a width of 18 ins. and depth of 24 ins. A ¾-in. pipe connection is secured to the vat, leads down to the bottom of it and ends in a ¾-in. union double tee. Four pipes capped at the ends are secured to this tee and the pipes perforated with 1/16-in. holes. After the lye has been placed in the vat, pressure is forced into the pipe and the contents of the vat soon become a liquid mass. Any over pressure or gas escapes through the automatic vent in the lid.

The buckets are of various diameters, and the pins near the rim indicate the proper amount of each ingredient required to insure the production of a similar quality of grease at all times. A uniform temperature of the various ingredients must be maintained, otherwise the mass when solidified will present a mottled appearance. This temperature should not be less than 95, nor more than 125 degs. F. The latter temperature insures a much harder grease than the former, and the harder grease is better adapted for summer use.

When everything is ready the press is in position to force, by air pressure, the contents into the funnel from which it escapes. It is then cut up into suitable lengths and shipped to all points of the C. & N. W. system.

Around this funnel is a steam coil ⅜ in. in diameter, which radiates heat sufficient to facilitate the movement of the grease toward the funnel outlet. As the grease comes out of the funnel in a cylindrically-shaped stick it passes under a circular disk provided with pegs. As the wheel revolves these pegs act as circuit breakers and the cutter cuts the stick of grease in suitable lengths with either an upward or downward stroke. It is then packed in boxes ready for shipment. Each engine is provided with a can to hold a certain quantity of rod grease.

This plant at Clinton not only makes the grease for rod cups, but that used in driving cellars as well. The daily output of this plant is 2,688 lbs. in 10 hours, and two men are employed to do this work. The entire plant is home-made, and the material used is similar to that which may be found at almost any shop in the country. The air and grease cylinders are made from locomotive cylinder bushings. An 8-in. air pump is used to compound shop pressure when the latter falls below 120 lbs. This pressure has been found necessary to operate the pistons in forcing the grease from the press.

Westinghouse Electric Locomotives Ordered.

Ten Westinghouse electric locomotives have been ordered for use on the Metropolitan Railway, of London, England. These locomotives, which will be of 1,200 h.p. capacity each, will be employed to operate 120-ton trains at an average speed of thirty-six miles per hour. They will be equipped with four motors of 300 h.p. capacity each.

ROOM IN GREASE PLANT, CHICAGO & NORTH-WESTERN RAILWAY.

A feature of the engine will be that, owing to the terminal facilities being somewhat restricted, it has been determined to adopt motors of a smaller size than usual, equipped with forced ventilation, so as to keep down the length of the locomotives to convenient limits for handling.

The Quincy Granite Road.

BY S. HARRY FERRIS.

The old Bay State is rich in spots that are hallowed by their association with the great events of the past. Boston, in particular, is a mecca toward which many thousands of historical pilgrims turn their footsteps every year. They patiently climb to the top of Bunker Hill monument, and stand in awed silence while they look out over the roofs of the city that has played such an important part in the drama of the nation's progress; they visit the ancient "Cradle of Liberty," and pay patriotic tribute to the glorious memories that cluster around the place; they search out the Old South Church, and linger with palpitating hearts upon the scene where Adams and Warren thundered their orations in behalf of liberty, and the participants in Boston's famous tea-party assembled, previous to proceeding to the harbor to brew the

SECTION OF THE ANCIENT SUPERSTRUCTURE

beverage that so disturbed the digestion of King George; they penetrate the squalid regions of the dark North End to gaze upon the belfry in which the signal lanterns of Paul Revere were hung; they block the roadway of busy State street while they cogitate above the square yard of pavement that covers the exact spot upon which the first blood of the Revolution was shed, and last, but not least, they reverently kneel while they silently revive the sacred memories of childhood at the foot of a little mound in the Old Granery Burying ground, that covers all that is mortal of "Mother (Mary) Goose."

There is one historical spot near the old Puritan town, however, that has been largely neglected by historical pilgrims in the past.

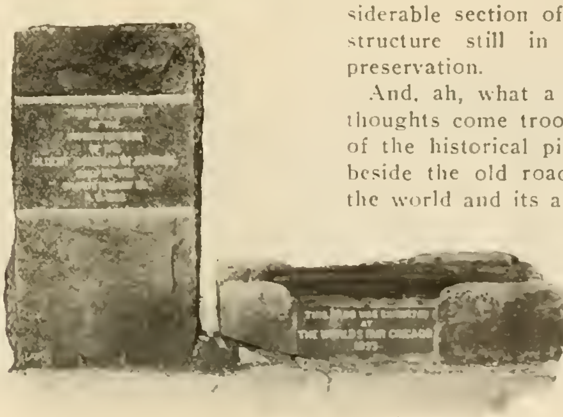
That is the place where the American railroad was born. Why it should have been thus neglected is, perhaps, difficult to say, unless it be that only comparatively few people are aware of its precise location. For, if it be a good investment of time to visit a place that is of interest because of the important part it has played in the nation's political and social history, surely it must be worth while to stand where a great industrial enterprise that has annihilated time and space, joined the Atlantic to the Pacific, built great cities and towns—in a word been the foremost factor of importance in making the country what it is—had its beginning.

THE ORIGINAL AMERICAN FROG.

To visit the birthplace of the American railroad the pilgrim in search of historical shrines should alight at a small station labeled "East Milton," half a dozen miles south of Boston.

Leaving the railroad station the visitor will walk down the track about half a mile in the direction of Boston; there he will suddenly come upon a large granite monument standing just at the edge of the road-bed. How strange!

The somber granite slab seems very incongruous amid its surroundings. It produces the impression that it must have strayed from some quiet section of a nearby cemetery, but as the pilgrim draws near the stone and reads its inscription he becomes aware that it has been placed there to mark the site of the birthplace of the American railroad.



"THE SITE OF THE BIRTHPLACE OF THE AMERICAN RAILROAD."

Bunker Hill Monument was about to be erected, and it was determined that the granite for the mighty shaft should come from Quincy, Mass.; but how to get the great cubes of stone from the famous quarries to the scene of construction was a puzzling and difficult problem. To cart the material overland by horse power was an absolute impossibility.

About this time rumors of the success of railroad operation in England began to reach this country, and the owners of the Quincy quarries immediately formed the Granite Railway Company, and in 1827 the first rail transportation line on this continent was completed. It was about three miles long, and extended from the quarries to tide-water near the mouth of the Neponset river.

Viewed from the standpoint of to-day, this first railroad on American soil was a rather curious affair. It is hardly necessary to say that there were no block signals, or split-rail switches. As a matter of fact not even T rails were available; neither were wooden ties used as they are to-day.

In constructing the road the builders first laid, end to end, blocks of granite that were a yard or more long and six or eight inches square. To the inside edge of these blocks they spiked strips of iron that were about one-quarter of an inch thick, and two and one-half inches wide. This combination formed the rail. Such necessary appurtenances as frogs for cross-overs were made by chiseling out grooves in great cubes of granite that weighed several hundred pounds.

But with all its crudeness, the old-time construction was builded well, and visitors to the site to-day find a considerable section of the ancient superstructure still in a good state of preservation.

And, ah, what a host of suggestive thoughts come trooping into the mind of the historical pilgrim as he stands beside the old road-bed. How vastly the world and its affairs have changed in three-quarters of a century. What a picture of progress and improvement is presented by a comparison of the ancient superstructure, and its track of rough-hewn granite, with the permanent way of a well-equipped modern railroad. It is indeed a far cry from the little railway that was built to carry the product of the Quincy granite quarries, to the great transportation systems of to-day, with their tens of thousands of miles of glistening steel rails, over which the commerce of a mighty nation is moved.

In the onward march of railroad progress, improvement has kept step in all departments, as is shown by a glance at a venerable passenger coach, that is now stored near Boston, and is in itself worthy of a visit from the historical pilgrim. This vehicle was used on one of the earliest New England railroads. In appearance it strongly reminds one of the days of Mr. Tony Weller, in old England, and the Deadwood stage line in this country. It is, in fact, nothing more nor less than an ordinary road coach hung upon leather-strap springs, and mounted on flanged wheels that are suitable for running upon rails. Yet this odd, old vehicle, that looks as

A VENERABLE PASSENGER COACH.

though it might be a first cousin to the deacon's famous "one-horse shay," and has so little the appearance of ever having been used for carrying railroad passengers, is in reality the direct ancestor of such magnificent cars as at the present time make up the Empire State Express and other celebrated trains of the country.—By courtesy of *The Four Track News*.

Education of Grand Trunk Employees.

In the discussion of a paper on Technical Education of Railway Employees, read by Mr. George M. Basford, Mr. W. B. Robb, Superintendent of Motor Power of the Grand Trunk Railway, gave the following interesting account of what is done by his company to educate and train employees. He said:

I have realized for some time that the teaching of our employees, and especially our apprentices, for positions of responsibility in the motive power department, was a question which could not be neglected, and the system which we have, while it has been in force on the Grand Trunk for a number of years, latterly it dropped away; but I found that there was a shortage of material, that we ran out of men, and I had difficulty in obtaining men for positions of responsibility, difficulty even in obtaining men for good positions as workmen, and I decided that it would be necessary to educate our own men. I therefore introduced the apprentice system, starting in with indenture papers. Every boy is indentured. He signs himself and is signed by his parent or guardian, and these indenture papers prevent them from joining any union as long as they are serving their apprenticeship.

Now, we had difficulty in obtaining apprentices when we started, a great deal of difficulty; but after the system became known and the parents realized the benefits which the boys would receive, that difficulty disappeared. For your information I will just tell you the number of apprentices we have. At Montreal we have 234 machinists, 90 apprentices, a percentage of 38; at Toronto 64 machinists, 25 apprentices, a percentage of 39; at Stratford 289 machinists, 110 apprentices, a percentage of 38; at Fort Gratiot 110 machinists, 60 apprentices, a percentage of 54. We have an average of 40 per cent. of apprentices.

At first the system was voluntary—that is, the drawing and the teaching of apprentices; but I found that woud not do, and it was made compulsory. An apprentice boy is given to understand when he comes in that he has to pass an examination. Unless he passes that examination successfully he cannot enter the service. The schools start in October and they end in April. The list of apprentices is given to the teachers. The teachers are provided by the company, as are the room, the light and the heat, and all that the apprentice has to do is to buy his own instruments. The list of names is given to the teacher of every apprentice in the works, and the roll is called. Every boy who is absent has his name sent to the master mechanic the next day as a warning, and he has to give a reason for his absence. If his reason is good it is accepted; if not, he is censured. If he does not attend he is discharged. The boy has to pass an examination before he receives his increase. All the increases received are on his indenture papers. We deduct from his daily rate and keep a percentage until he is out of his time. When he is out of his time that money is paid to him, and along with a bonus. We have found that by having that system of indenture and holding the money back we are able to hold our apprentices, which we formerly were not able to do.

The examination takes place before the shop expert, and it includes drawing and all the subjects of the system of examination. It is a written examination, and it all comes up before the master mechanic, receives his approval, and then comes to me. If his examination is not satisfactory he is sent back for six months and receives no increase. If he fails on his second examination he is discharged. In addition to teaching drawing we are now teaching them theory, applied mechanics and mathematics. We have no difficulty, as I said before, in getting apprentices for machinists, but we did have difficulty in getting apprentices for boiler makers, blacksmiths and rivet boys and steam hammer boys, and it was necessary to take on younger boys and boys who did not have sufficient education to pass the apprenticeship system. We have now introduced a school along with the drawing and the other training to teach these boys writing, arithmetic, reading and spelling, and they come in younger than the other apprentices. They have to pass examinations on that as well as on the other, and after they pass that examination they are brought forward as machinist apprentices. In the spring of the year, at local points, prizes are given for the best standing. That is, locally. In addition to that prizes are given for the whole system, for which the boys compete over the entire system. Now, I want to say that I can assure this association that we find a very great deal of benefit from the system which we have. In fact, we have reached the point now where we are able to get sufficient material for promotion on our own system without having to go outside for it.

Locomotive Sixty Years Old.

On account of the strenuous life which modern locomotives are compelled to lead on a crowded and busy line, one does not often see a really old engine. An exception to this rule has been found in Cuba. It has run continuously for sixty years on a branch of the Santiago de Cuba. It was built by Mr. W. H. Baldwin.

In 1847 and 1848 two locomotives were built for the Havana & Guiness Railroad, and one of these is the sixty year old machine now in Cuba. The cylinders are 14½x18 ins., and the pistons drive on a crank shaft. The weight of the engine is about 36,000 lbs. The engine has what is known as a "flexible beam truck," and this was patented by Mr. Baldwin in 1842. There is no engine truck, and sufficient lateral movement of the driving wheels was thus secured, the engine being able to take all the curves it encountered with ease, and this arrangement placed all the weight on the drivers.

The engine is a wood burner, with an old fashioned widely tapering stack, which was intended as a cinder collector as well as smokestack. The engine is in freight service and has been constantly in use with the exception of the brief intervals in which inspection and repair work had to be done.

A High Speed Foreman.

BY A. O. BROOKSIDE.

Once upon a time there was a locomotive foreman and he believed in high speed at all hours of the day and night. One beautiful moonlight night he was called upon to go out and clean up a moderate kind of a freight wreck, and he did the business with neatness and dispatch. In order to facilitate matters he burned up half a dozen freight cars, more or less, which were badly off the track and pretty well knocked about, and which did not have any "paying load" in them. This is the modern railroad equivalent for "freight," when you are speaking as one who knows.

LONDON AND NORTH EASTERN GOODS TRAIN PASSING OVER WATERTROUGHS AT BUSBEY.

He got the road clear for traffic and pulled everything clear of the main line and went home leaving the tangled mass of wrought and cast iron to cool. In due time it radiated its heat to the circumambient air and lay there a silent but twisted asset of the company. On Sundays for a week or two thereafter he picked up this scrap and took it home, and all went merry as a marriage bell.

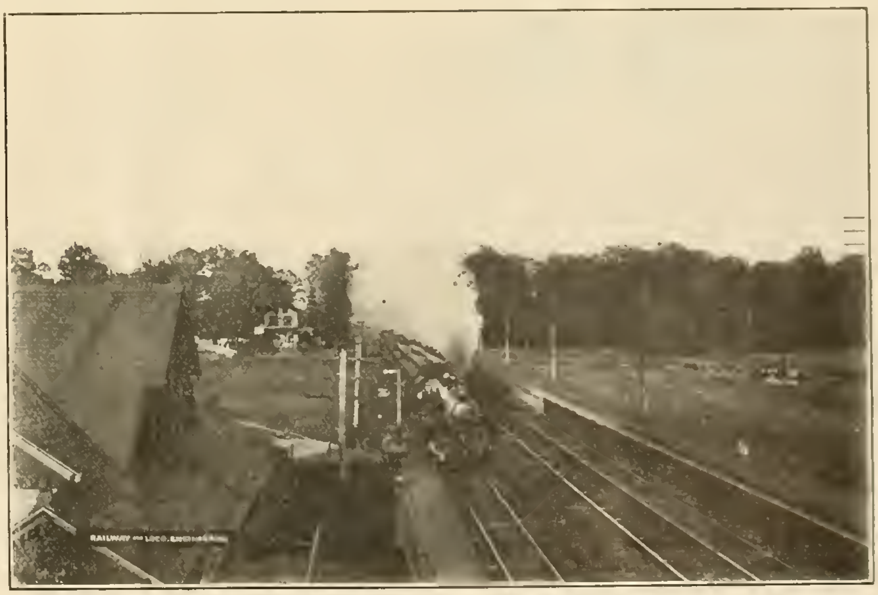
Time went on, which, as Artemus Ward once remarked, is a way time has, and the scrap became available. The high-speed foreman being supplied by nature with considerable "gray matter," in what scientific people call the "brain case," when they speak of a skull, came to the conclusion that this scrap material was "all to the good," and he fell upon it like the July sun falls upon a mountain glacier which has slipped its anchorage.

The H. S. F. found that a great many of the castings in the debris were still O. K., and that the bolts and rods, etc., were not only none the worse for wear but had been, so to speak, annealed when he burned up the wrecked cars in clearing the "right of way." If a bolt happened to be bent, it was easily straightened, for this very reason, and in 97.86534 per cent., the threads were intact, so that when the curtain went down at the end of the second act, the car repairers and other kindred spirits were howling with joy, and the high speed idea was on top, and likely to be called before the curtain several times.

The high speeder reasoned this way when he came to make up his accounts: "This scrap came from All Wool & Ayard Wide Railway cars (which is the road I clip my coupons from), and that company owns this high-grade scrap in fee simple, as a lawyer would say." He said to himself, as he looked out of his office window, and saw the 110 come in on one side (badly blocked by that ass, Stuffy Shortt, who ought to be running a wheelbarrow and not an engine): "The company owns this scrap, and it has been charged out to cars before now; why should I charge it out again?"

High Speeder came to the conclusion that by not charging out any of this scrap as he used it on cars belonging to his own road that he could make his car repairs look that much cheaper; and he didn't charge any of it when he used it on his own cars, but if he used it on foreign cars—look out! His accounts went in to the M. C. B.'s office, a long way off, and moons waxed and waned as they had been in the habit of doing since the birth of time.

At length the eagle eye of the assistant mistake catcher got busy and he showed the bill for car repairs at Highspeedville for a month to the chief mistake catcher, and the latter said, "What's wrong?" "Oh, nothing," said the A. M. C., "only there is no material charged, and there is any amount of labor." The chief snatched the papers from the nerveless hands of the A. M. C. and proceeded to ponder over them alone at his desk for some time. He smoked a long, black cigar the while. Here the curtain dropped but no one came before the footlights.



HOW SHE LOOKS FROM AN UPPER WINDOW ON A NO-STOP RUN

Later on the high-speed foreman got a letter signed by the M. C. B. (in small type, per the C. M. C. in large letters) to the effect that he, the M. C. B., would like to know why several men (car repairers, to wit) had been kept busy, and to all appearance, fully occupied, repairing cars, but that though the amount of time charged at several cents per hour showed that the men had been doing well, they had not succeeded in putting any material on any of the A. W. & A. W. Ry. cars (the numbers of which were given, with dates), and that he, the M. C. B., alias the C. M. C., alias the A. M. C., would like an explanation—not because they believed things were strange or in any way irregular, but there was, of course, the remote chance of the furious G. M. asking "Why?"

The high-speed foreman thereupon awakened from his dream, and saw at a glance how people who have lots of pens and ink and paper at their disposal with the authority to say "Please explain," can cause any amount of trouble or a first-class railroad. He also felt sure that there must be some subtle proportion existing between time occupied and material used, and that the sooner he got in out of the wet when it came to account keeping, the better it would be for him, the men under him, the M. C. B., the C. M. C., the A. M. C., the G. M. and the entire staff of the All Wool & Ayard Wide Railroad Company when dealing with their own cars. He still wonders why he was never asked the reason he multiplied the weight of the high-grade scrap saved from the wreck by two, or even three, when he charged it up to foreign car repairs. He is a high-speed foreman yet, but he knows a lot about the judicious use of brake power now, and he doesn't get nearly as many bothersome letters as he did about scrap.

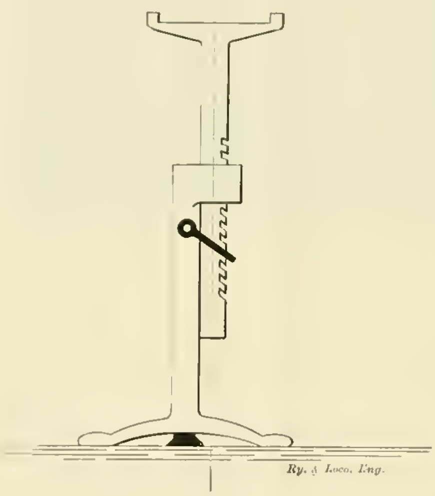
Blacksmith's Adjustable Stand.

If you should happen into the smithy of the Wilmington, Del., shops of the Pennsylvania, which are presided over by Mr. Sawin, the foreman blacksmith, you would see several handy little blacksmith's adjustable stands, something like the one shown in our sketch.

There is nothing very wonderful about it, and it is home made; in fact, a man here and there will tell you—and this is true of home-made devices the world over—that he has not had time to finish it. The little stand is three-legged; that means it will stand on any kind of ground, rough or smooth, the upright piece is made out of ordinary flat iron of a size commensurate with the work it has to do, and at the top of the upright piece, one side has an overhang pierced so as to take another flat bar of similar dimensions to the first.

This second bar slides freely in the opening of the overhang, but this second bar is notched along its outer edge with big or little notches just according to the size of the whole device. Now in order to prevent the second bar from sliding down alongside of the first when not wanted to, there is fixed on the first, a bale, or a detent, of a U-shaped staple, or whatever you like to call it, for there are many names which may be applied to a small and useful thing. This catch, to use one more name, is pinned to the first upright and engages with the various notches in the second, and thus the T-shaped top may be placed at and maintained at any height required.

The stand is used to hold the ends of bars and rods at the forge. When a bar has one end in the fire and extends so far beyond the forge that it would tip up, this stand steps in and holds the free end and keeps the bar level. When the smith wants to raise or lower the movable part of the stand he hits the top what pugilists would call an "upper cut," and this loosens



HANDY ADJUSTABLE STAND.

the catch, and by holding the catch free for a moment adjustment can be made at once, and letting go the catch the whole device jolts pleasantly back in position and all goes merry.

Railway Training School.

The Railway Commercial Training School, recently established at Elmira, N. Y., owes its origin to Mr. F. D. Underwood, president of the Erie Railroad, who is always doing something to promote the education of railroad men, and has displayed a practical interest that has been beneficial to many people eager to work themselves upwards in their chosen calling.

Its primary object is the training of young men for positions as railway station agents. The ultimate outcome of the training that may be obtained there rests with the student himself. There is no limit to it this side of a seat in the president's chair, as the executive head of a great railway corporation. Practically all of the directing heads of the railroads of this country to-day have worked themselves up to their present positions from some such subordinate positions as station agents, trainmen or chainmen on the civil engineering corps.

Up to the time of the establishment of this school there was no place in existence where the rudimentary, technical and theoretical knowledge necessary could be obtained by young men desiring to enter into the business of practical railroad operation. As the demand for young men possessing this knowledge is practically constant, the scheme is one that has met with the instant approval and co-operation of railway managers, several of whom have agreed to give employment to the students of the school as soon as they have completed their course and received their diplomas. As the supply of competent station agents is never equal to the demand, this school seems to offer an exceptional opportunity to young men between 18 and 25 years of age, to step into positions that pay the occupants from $40.00 to $125.00 per month, according to the size and importance of the station at which they are located.

Heretofore station agents have generally come from messenger boys and helpers who, like Topsy, have "just growed" into their positions by accident rather than through the process of selection. And likely as not they have "growed" up wrong, either because their individual instructor had taken no special interest in the boy he was supposed to be training, or because the station agent himself was but imperfectly trained in those niceties of his duties that help to make the perfect railroad man, and, therefore, unable to impart his laboriously acquired knowledge as it should have been done.

It was with the idea of remedying these conditions, which railway managers have so long deplored, that the Railway Commercial Training School was established. It is the outcome of the ideas of one of the most prominent railway officials in the United States, under whose suggestions the whole plan of instruction was evolved. Being wholly new in conception, special text books had to be compiled and published for the use of the students. This was done by two gentlemen who have been connected with the practical management of one of the great trunk line roads for years, and who were thoroughly familiar with the duties of the positions for which students are to be trained. All the papers and reports, such as bills of lading, freight bills, agents' reports, tariff sheets, freight classification sheets, and the scores of other forms required in the actual business of transportation were also prepared for the use of the students. Then a school room which was, in effect, a railway station in daily operation, was fitted up, and there the students receive instruction in the multifarious duties of a station agent, under the immediate direction of Mr. W. G. Moore, a gentleman who has had many years of experience in railroading, and who combines with his practical knowledge peculiar aptitude for imparting his knowledge to others.

The scheme of instruction is divided into four general divisions. The first and only theoretical one has to do with the organization and management of a railroad system. Here the student learns about capital stock, bonds of various kinds, the work of organization and construction as actually pursued by a railroad corporation. This is supplemented by instruction as to the duties of the various railway officials from the president down to that of the humblest employee, and finally of the relations of a railway corporation to the public. This knowledge is imparted in a course of lectures supplemented by class room exercises that go into the ethics of the whole business.

To the practical side of the business the other three departments are devoted. They have to do respectively with the duties of the freight agent, the passenger agent, the telegraph operator and train dispatcher. They present the busy side of the student's life at school. As a freight agent he must receive, classify, bill, make rates for, assign to cars, and see to the proper routing of imaginary freight sent him for shipment. Here he learns the intricacies of foreign, local, through, express and special freight shipments, and is taught how to get the freight away from his station with speed and accuracy, and how to get cars in which to make his shipments. The duties of a receiving agent mastered, he is then taught those of a distributing agent, and how, as such, to deliver the goods, look out for claims of loss or damage, verify computations, correct way bills, allot payments to the different roads that have acted as carriers of his particular carload or train load of freight, and perform all the other duties that are required of his position, including the making of all necessary reports and papers. It is all a marvel of detail, and yet the students take to it kindly and with actual enthusiasm, as there are enough new problems constantly arising to keep them ever interested and entertained while they are learning, for there is a true fascination in the working out of the puzzles that the course of instruction constantly sets before them for solution.

A department which proves of particular interest to the students is the telegraph department, which is in charge of Mr. E. E. Tingley, an expert telegrapher and electrician, who has had 30 years' experience on one of the chief trunk lines of the country as operator, train dispatcher and chief dispatcher. This department is completely equipped with all the necessary fixtures and appliances of the most approved designs. Through the courtesy of the Erie Railroad, a railway wire has been run through the school. Here, not only the actual work of telegraphy is taught, but the care of instruments, batteries and the practical details of the work as well. Individual drill with the instruments is given the student daily in addition to his class work. Standard block signal rules, train order forms and all the other work that devolves on the station operator, is carefully and thoroughly taught personally by Mr. Tingley, who has the happy faculty of being able to successfully impart to the student his own knowledge of these subjects.

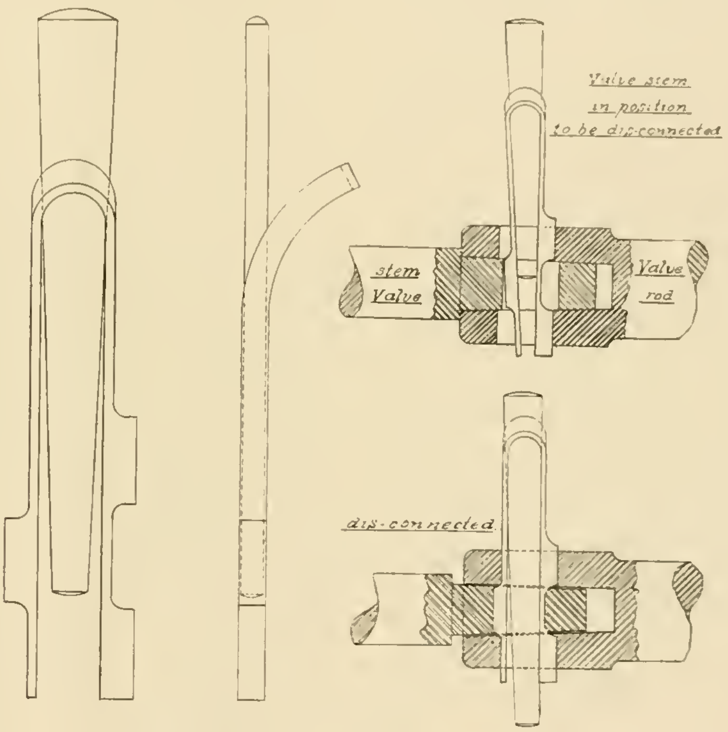
Endorsed as this school is by the railroad managers, who see its great possibilities, the aim of the management is to so conduct it that it shall be what the technical school is to the future engineer, the commercial or business college to the future business man, the normal training school or school of pedagogy to the future teacher—to fit them completely and perfectly for a life work. Besides the technical training its management aims to instill in the minds of the students that highest of all ambitions, the clean life and the attainment of that high standard of personnel that alone spell success in the conduct of business, be it that of a railroad or any other.

The school is not being operated for profit, the fees being simply enough to pay running expenses.

Valve Stem and Piston Rod Disconnector.

We here give a sketch of a handy rig for disconnecting valve stems and crossheads from piston rods, which has been sent to us by Mr. Joseph Korff. It is used in the Utica shops of the D., L. & W. road. The device is not new in principle but is published for the benefit of those of our readers who have not seen it made just in this way.

After the valve stem or crosshead key (as the case may be) is withdrawn the little device here shown is dropped into the keyway, so that the two projections on one side press against the socket, and the one projection on the other, presses upon the end of the taper fit of the valve stem or piston rod. A few vigorous blows on the top of the taper key or wedge which fits in the center of



VALVE STEM AND PISTON ROD DISCONNECTOR.

the handy little appliance is sufficient to slack back either valve stem, or piston rod out of its seat.

Two sizes of this device are necessary, one for valve stems and one for piston rods, but the principle is the same in each. The whole can be made of steel with sufficient spring in the three-projection piece to require slight compression when putting it in the keyway, and the fact that its upper curved portion comes out clear of the wedge piece enables both to be readily adjusted by hand and leaves the top of the wedge clear so that driving down the wedge does not interfere with the other part.

The use of some such device as this makes the removal of piston from crosshead comparatively easy and does not put an undesirable strain on either.

Valve stems which have to be very frequently disconnected to enable the renewal of valve stem packing to be accomplished may by this means remain uninjured until the end of the chapter and not show the upper edge of the socket "bashed" up by hammer blows which are intended to help jar the mechanism apart.

B. & O. Mallet Compound.

In his paper on "Locomotives of Great Power," Mr. J. Muhlfeld said: "The Mallet articulated duplex compound type of locomotive gives evidence of the Americanizing of foreign practice for the purpose of providing a locomotive for special service on heavy and long mountainous grades with considerable curvature, where the helper service is such as to require the use of the most powerful locomotives to maintain the balancing of the power on the division and to eleminate the use of two 100 per cent. consolidation type of helper locomotives through the use of 170 per cent. locomotive, which is of sufficient capacity to meet the requirements and handle the service otherwise taken care of by the two relieved consolidation type.

By the use of a single, instead of tandem locomotives, the advantages, due to a reduced number of bearings and parts, decrease weight per unit of tractive power developed, the elimination of unnecessary dead weight and non-paying load, and the control of the operation by one engineer and one fireman instead of by two engineers and two firemen, results in a better handling of the service, less liability for accident, greater paying tonnage to be hauled per train, and reduced operating and maintenance expenses.

The application of this design permits the use of a maximum effective wheel base, with a materially reduced rigid wheel base, and provides for a helper locomotive that can develop an average through freight train speed without liability for excessive wear or failure.

The sub-dividing of the power through the use of four independent cylinders, pistons, main rods, crank pins and frames, in place of two, and the better balancing of the reciprocating parts, results in the lessening of the strains on all parts, and reduced liability for wear and breakage. While the wearing and total parts per locomotive are increased, they are greatly reduced when compared with the development of the same power by tandem locomotives, and the reduced stresses and weight should provide for a more satisfactory and economical maintenance of those details most liable for repairs.

The performance of this engine in service seems to support the claims on its behalf made by Mr. Muhlfeld. The publicity department of the road recently sent out some notes about the performance of the engine, among which are:

"The successful performance of the articulated duplex compound freight locomotive of the Baltimore & Ohio Railroad, in helping push heavy freight trains over the rather steep grades on the Alleghany mountains, is very gratifying to the management of the road. railroad experts generally and the builders of it.

"This locomotive has made several road trips and been in mountain-helper service during the past five months, and in this time it has made about 17,000 miles. It was designed for the purpose of balancing the power on the division and to reduce the number of locomotives and crews required to handle freight tonnage over the mountain districts, and thus greatly facilitate the movement of traffic, which has grown so largely during recent years and is growing very rapidly under the present management of the road.

"It is really a pair of locomotives with one boiler, which is carried on two sets of driver wheels, each of which is 57 ins. in diameter. When in working order the locomotive weighs 334,500 lbs., while the tender attached (which has a capacity of 15 tons of coal and 7,000 gallons of water) the total weight is 479,500 lbs., or about 193,300 lbs. less than the combined total weight of two of the heaviest consolidation locomotives that are used for other freight service over the same mountain district.

"While the draw-bar pull behind the tender of two of the consolidation locomotives is about 79,400 lbs., the draw-bar pull of the big locomotive is about 74,000 when working compound, and 84,000 lbs. when working simple. The weight of trains that can be taken up the mountain by two of the consolidation locomotives is about 2,025 tons contained in loaded steel cars of about 100,000 lbs. capacity, the weight of the train the No. 2400 and one of the consolidation locomotives can take up the grade is about 3,210 tons contained in similar cars. These figures are based on the locomotives operating at a speed of ten miles per hour, under fair conditions, and with the big locomotive working in compound gear."

A Pet Veteran Locomotive.

When the trainmen of a railway become fond of a locomotive, they always have many loving stories about her. Old 148, of the Delaware & Hudson, has been sold and here are some tales told by affectionate trainmen:

"No hoodoo stories about 148. Lots of good ones, though—how she would get right down to business when some poor fellow had a sick friend somewhere and wanted to get through quick, and hustle like lightning to get him home. I could tell you a lot of such stories.

"And then you know what awful grades there are on the Delaware & Hudson. Many and many a train has lost her grip and gone thundering down to death and destruction. It isn't so very long ago that a freight got away over near Binghamton and ran down the hill. Did a pile of damage, too.

"But old 148 was too careful for any such thing as that. She had a grip on the rails like iron. Her feet never slipped to do any harm. She would hold back like a mule on a steep road."

And Yard Master E. Cline adds his testimony to the universal verdict regarding the many virtues of the old engine.

"She would do more work after she was taken off the road and set to work in the yards here than any other engine we have. All you had to do was to give her a gang that could keep up with her and she would make things hustle.

"Stout? Why, she was a perfect giant! And talk about engines being cold and bloodless and inhuman! Why, 148 knows as much as any man, and has a good deal more sense than lots of men I know of.

"Careful, too, of the lives of the men who were working with her. You could put her within half an inch of where you wanted her every time and she would stay right there till you were all ready to go; no slipping and sliding around.

"And so ready to go when you said the word! I never saw an engine that would pick up a train right from the word go as she would.

"No; it'll be a long time before we see another engine that has so many good qualities and so few bad ones as 148."

And that is the universal verdict. But 148 has made her last trip over the Delaware & Hudson.

Man or Mouse?

When young Elihu Root was leaving home to look for work, his father offered to give him letters of introduction to influential friends, but the young man refused to take them, saying, "I am starting out to do this for myself. I'm going to make my own friends without any family pull. I want to find out whether I'm a man or a mouse."

There is a fair proportion of young Americans who are prepared to prove themselves by working out their own salvation unaided. They demonstrate their own manliness and rise to positions ranging from capable engineer to president.

Officials belonging to the Pennsylvania Lines West of Pittsburgh are investigating the merits of the Hayden Company's automatic stoker.

General Correspondence.

Taking Chances.

Editor:

Although laws have been enacted compelling railroad companies to equip their cars with the modern safety appliances, and this law has been, with but few if any exceptions, complied with, yet the reports of injury and death to men employed in train service keep high. If now a law could be put in force making the reckless carelessness of trainmen who take chances with fate a crime it would most certainly show a decided falling off in the list of accidents to the class of individuals named. This carelessness is in evidence in all railroad yards, and probably will remain so unless something more than a book of rules is brought into effect to stop it.

In the days of the pin and link brakemen were prone to rush in "where angels would fear to tread," take out or insert a link, or set the pin while cars were moving at a speed anywhere from 3 to 6 miles an hour; they invariably had to run backward while doing this work, and when the desperate chances then taken are considered it seems almost a miracle that more of the craft are not now sleeping away the years.

Another desperate chance which in those days was in continual evidence was the practice of jumping in between moving cars to pull a pin. Many life lights have been snuffed out in the years gone by through that practice, and the fault was chargeable only to the parties themselves, many of whom paid the forfeit with their lives. The practice of standing between the rails waiting for the approaching engine or car is as old as the railroads.

Having given thirty-four years of my life to the traffic departments of various railroads, and always having been a careful observer of events, I figure that fully 75 per cent. of the accidents which have occurred to trainmen in the years past might have been averted had good judgment and prudence been observed on the part of the men themselves. "Self-preservation is the first law of nature," and this instinct seems to be dominant in all animal life, and it seems almost beyond belief that man, with the reasoning faculties with which he is endowed, would take a chance that a lower order of creation would flee from.

With the so-called "vertical plane" coupler in universal use one would naturally expect that the reports of injuries and deaths among train and switchmen would be few and far between. Yet the reduction in casualties is nothing as to what it should be. Why? For answer go into any large railway yard and watch methods. The fool who trifles with fate is always to be found. Watch him. There is a coupling to be made. Both knuckles are closed. One of them must be opened. See him in front of that car, which is moving anywhere from 4 to 6 miles an hour, raising the knuckle pin with one hand and pulling out the knuckle with the other; what is the difference? How much less risk is this man taking than was taken by trainmen in past days when links were removed or inserted under like conditions? In both instances the workman must necessarily run almost squarely backward.

Here is another fellow; watch his movements. Train has pulled up over switch and he signals engineman to give cars a "kick." He waits at switch-stand for the approaching train, and when the car or cars that he wishes to cut from the others gets opposite him he makes a grab for the pin lifter and finds it will not lift knuckle pin. Look again, regardless of the fact that cars by this time are moving anywhere from 6 to 10 miles an hour; you will almost invariably see him jump between the cars to raise one or other of the knuckle pins by hand. What is the difference between this last named method and the practice so extensively in vogue in the days of the pin and link? The only reason that there are not as many killed or maimed for life as in the past is for the reason that it is only now and then that a pin lifter is out of commission. Judging from my experience I have reached the conclusion that the greatest agency for safety in the vertical plane coupler is to have pin lifters in good working condition. You can see in these days about as much jumping in front of approaching cars to adjust knuckles as was seen in the past in the inserting or removing of links, "cocking" pins, etc. It is but reasonable to conclude that the new coupler is not a factor of safety to the man who violates the laws of self preservation and violates a duty that he owes to his God, his family and himself.

I have in times past remonstrated with my fellow trainmen for their foolhardiness, and have almost always met with the answer that if they would do as I suggested they could not hold their jobs, and that they would be considered too slow. My answer has invariably been, "It is demanded of you in the company's rules that you take the time and necessary precaution to prevent injury to yourself, and should some subordinate employee make trouble for you on account of your discretion carry the case to higher officials. You will not only get justice, but possibly commendations for your prudence." I do not, I cannot, believe there are any men serving in official positions on our railroads who will demand of men the taking of chances heretofore enumerated. I do know, however, that men serving in subordinate capacities shut one eye to the practice, and for that particular reason if for no other the practice has become universal, and to the rank and file is considered an unwritten law.

It would seem that the time has arrived when strenuous methods should be adopted by those in power, not only on the railroads, but in our legislative halls, to safeguard the railway employee whose "bump" of caution and prudence is so abnormally small that he will needlessly and recklessly take chances, oblivious of the fact that he has loved ones and that his life is needed that others might not suffer. If this feeble effort of mine would create some new thought, some new effort that would prolong to mankind just one individual life, I would rejoice and would hereafter be happy in the thought that possibly I had not lived in vain.

J. W. Reading.

Grand Rapids, Mich.

Observations on Locomotive Front Ends.

Editor:

When considering the stack for a 54-in. front-end, the highest efficiency is obtained by a tapered stack, tapered 2 ins. per foot, with its smallest diameter a distance of 17½ ins. from the base. The greater the height of stack the greater will be its efficiency. Tapered stacks, whether long or short, should equal in diameter at inside of choke one-fourth of the diameter of the arch. The diameter of the stack should be diminished as the nozzle is raised.

Professor Goss gives the following formula for determining correct nozzle heights. H equals height of stack: h equals distance in inches between center line of boiler and nozzle: d equals diameter of choke of stack, and D equals diameter of front-end. The formula for tapered stacks is as follows: When nozzle is below center line of boiler: d equals .25 D plus .16 h. When nozzle is above center line of boiler: d equals .25 D minus .16 h. When nozzle is on center line of boiler: d equals .25 D.

The formula for straight stacks may be stated by saying: When nozzle is below center line of boiler: d equals (.246 plus .00123 H) D plus .19 h. When nozzle is above center line of boiler: d equals (.246 plus .00123 H) D minus .19 h.

THE PETTICOAT PIPE.

As a means of increasing the induced action of the exhaust jet, rather than as a means of equalizing front and back the draft on the fire, double petticoat (or draft) pipes add to the efficiency of the front-end. When the distance between the nozzle and the choke of the stack (the top of the arch, with a straight stack) is not great enough to make a double pipe practicable, a single pipe is beneficial. The efficiency of the draft pipe is mainly due to its forming a longer orifice through which the exhaust must pass, thereby augmenting the induced action of the exhaust jet by solidifying it, it not being essential that the jet come in actual contact with the draft pipe. In fact, the pipe should be so large that the jet will not touch it.

In a 58-in. front-end the best results were obtained with a 14-in. choke stack, choke 12 ins. above top of arch, nozzle 45 ins. from choke, with a double petticoat pipe. The highest net efficiency was when the bottom end was set even with (but none below) the top of the nozzle. The top end of the upper section was set 13½ ins. below the choke of the stack. The total distance from nozzle to top of upper section, in this position, was 28½ ins. The smoke box vacuum decreased as the distance was lengthened to 31 ins., and the back pressure in the cylinders increased as the distance was shortened from 29 to 28 ins. The double petticoat pipe used in the above mentioned test was of following dimensions: Lower section, 10 ins. diameter by 11 ins. long; upper section, 13 ins. diameter by 10 ins. long. The flare on lower section was 7 ins. high by 17¼ ins. diameter at bottom; the flare on upper section was 2 ins. high by 15 ins. diameter at bottom end.

THE NETTING.

No data is on record of the amount of resistance to the exhaust jet due to the front-end netting, or perforated steel plate. The total area of netting should be as great, and its mesh as large, as conditions will, with safety, permit, as the open area is considerably reduced at each impulse of the exhaust by sparks in process of being broken up sufficiently small to pass through. As the direction of the sparks in the smoke box is from every point toward the column of the exhaust jet, instead of directly toward the stack, the netting should be set so that, as nearly as may be, the sparks will strike it at right angle to its face.

Although some railroads use coarser and others finer mesh, it is probable that the most preferable is netting with 2½x2½ mesh, No. 10½ double crimped steel wire, or, 3/16 in. x 1½ ins. perforated steel plate, with the plate set so that the slots run vertically instead of horizontally. The chief objection to the perforated steel plate is that it necessarily contains somewhat less open area in proportion to its closed area than netting. A point in its favor, however, is that sparks cannot as easily wedge in the perforations as in the mesh of the netting.

K. P. ALEXANDER,
M. M., Ft. S. & W. Rd.

Ft. Smith, Ark.

Brake Beams.

Editor:

The question of the strength and weakness of brake beams is being discussed at times by railroad papers, and as I understand the question, it is to get

FIG. 1

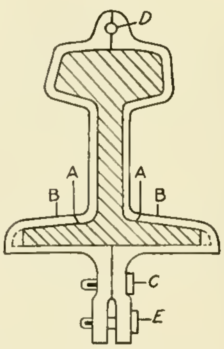


FIG. 3

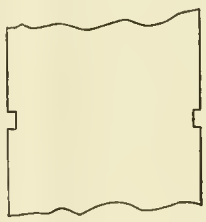
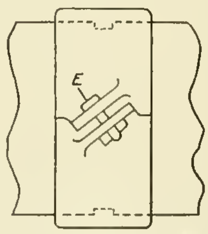


FIG. 2



BRAKE BEAM MADE OF PIECE OF OLD RAIL.

the maximum of strength with the minimum of weight. Such being my views your attention is called to a new form of beam. You will notice in Fig. 1 the cross section of a T-rail, my idea being to convert old rails of a given size into brake beams. I believe it is a safe assertion in saying that a section of T-rail that has been in use is stronger than any other form of rolled brake beam of the same weight, due to the hardness and rigidity imparted to the head by the rolling process of the wheels. In Fig. 1 is shown a clamp and jaws passing round the rail; this clamp is malleable iron and made in two pieces, each half having one jaw. The halves are held in place by split key bolts *C* and *D*, the keys should be drawn as also the brake lever bolt *E*. In each edge of the base, Fig. 3, is a recess punched out; one the inside of the clamp is a projection that fits into the recess to prevent it from moving sideways. It is best to avoid holes at this point. The cambre of the beam should be a cold bend if possible without fracturing the head. The bends necessary for the brake heads can be made hot. Fig. 2 shows base and angle of jaws, also the parting of the clamp. Now, if it is thought best not to carry the clamp all the way round, it can terminate at *A*, Fig. 1, and bolt through clamp and base of rail at *B*, providing the base will stand the pull.

This kind of beam is not patented; help yourself, brethren.

W. DE SANNO.

Fruitvale, Cal.

The Same, Only Different.

Editor:

The Birmingham Southern Railroad have two 20x24 in. switchers and there is a big difference in them, and quite a difference in steam pressure, and the one with light pressure will pull the most.

We tested the engine in this way. There is quite a steep grade coming in yard, and the engine that has 145 lbs. pressure came up to the switch, and slowed up to let switchman throw switch and could not pull train up the hill. The engineer took slack three times, and could not get the last car to move with engine red hot. The mate to this engine was at the roundhouse, and I had engineer put her on train with this engine that stalled still on the cars. It was a train of steel rails, and no brakes on cars. Brake staffs had to be let down, and if cars were cut to double in, the tail end would have run about three miles, so engine was left on train to hold cars.

Now the engine with 145 lbs. of pressure stalled and her mate with 130 lbs. steam pressure pulled the engine with 145 lbs. and her train also. The cylinder cocks on second engine were open and relief valves down, so there was no help from her at all and no one on her. I have had all kinds of arguments about this happening with three engineers. Some say one thing and some another. One man thought the throttle on the 145 lb. engine did not open wide enough, so the next day I stopped her and took up dome cap and found it opened 1½ ins. when wide open, so she was O. K. Next day I had engine that pops at 130 lbs. brought into the shop, and when the dome cap was taken off we found the throttle opened 1⅝ ins. when wide open. So you see it was ⅛ short of the 145 lb. engine.

There is not 1/16 in. difference in size of cylinder in both engines, and valves are of the same dimensions, every way, lap, lead, and, in fact, just alike, and the valves were set by the same man, and both engines same weight. Now the 145 lb. engine has tires 3⅛ ins. thick, and the 130 lb. engine tires 1¼ ins. thick, and both engines are in about same shape. I have a box of cigars at stake on it, and think I am right. The man I bet with said it is in her valves, but it is not. They are alike to a red hair, and if you people will settle this case, one of us will smoke.

Yours truly,

A. J. Monfee.

Box 22,

Pratt City, Ala.

[Our readers are invited to help settle this question. The engine with the greater pressure may be more "slippery" than her mate. Several causes may operate to produce the result given above. Our columns are open for a reasonable discussion.—Ed.]

Grinding a Throttle Valve.

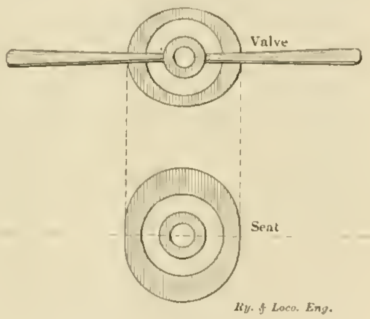
Editor:

The balanced throttle valve now almost universally used in American locomotives is a remarkably simple and admirable contrivance for admitting and controlling the supply of steam to the engines used in the propulsion of the locomotive. Its chief drawback is the difficulty, real or apparent, in making a perfect fit of the two bearings of the valve. In examining the causes that lead to this inaccuracy it will be found that, generally speaking, they arise from the thoughtlessness of the ordinary mechanic intrusted with the work of grinding the throttle valve. We might go further and state that it is not every shop foreman who knows an imperfectly ground throttle valve when he is called unon to inspect the job.

It is one of the most exasperating things that a foreman has to contend with in his daily experience, when after all the rush and hurry to get the engine out of the shop, to see the steam pouring out of the cylinder cocks as soon as a pressure begins to show on the gauge. He is at a loss how to account for the leak, for he inspected the valve himself and pronounced it to be all right. Sometimes he tries to draw comfort from the fact that a first-class man did the job. Then the old excuse comes to him that some metallic particles must have got under the valve, or perhaps oxidization has set in and red rust has gathered on the shining valve seats. Sometimes the inflamed imagination of the foreman runs along the throttle rod and he sees in his mind's eye the tightened packing disturbing and twisting and cocking the valve connection. Then the theory of unequal expansion rises on the troubled waters of his weary brain; but it is a condition that confronts him and not a theory, and the steam keeps remorselessly pouring out at every available orifice, and there seems to be no balm in Gilead. The foreman and his assistant are like the two unhappy men who were besieged in a tree by a bear—the one asked the other if he could pray? "No," he replied, "but *something* has got to be done."

When the fire is quenched, and the dome cap removed, and the throttle valve re-examined the mystery deepens. Some more emery and oil and misapplied muscular energy, and the dome cap is screwed down again. This is the time when a couple of crystallized studs break and have to be drilled out and replaced, and the copper joint must be annealed, and the master mechanic comes around and his subordinates begin worrying about their reputations, and the decreasing value of any promises they may make in the future haunts them like a nightmare. At the next trial the leak seems to have increased, and it must be the dry-pipe leaking at the stand-pipe joint, and so, in many cases, the work is all gone over again.

Now to begin at the beginning. It is not unlikely that the throttle valve may



SECTION OF THROTTLE VALVE.

have been all right when the engine came into the shop for repairs, that is, for other repairs, but unfortunately some mechanic is merely told to go up and grind the throttle. The mechanic proceeds to erect his little platform on the top of the boiler, sometimes at the front of the dome, sometimes at the back of it, according to which position has the most commanding view of the shop and its reconnoitering foreman. Then he uncovers the dome and takes out the valve and adjusts his T-shaped grinding-in spindle, and after applying his oil and emery he gets down to business. A stupid business it usually is. Supposing that he chooses the back of the dome for his platform, he throws his weight downward and forward upon the valve and saws away until the emery has been pulverized and renewed several times. During the process the crossbar of his spindle handles has been continuously nearly at right angles with the boiler. Occasionally he may give the valve a half turn without changing the position of the spindle tightly held in the valve. Sometimes for the sake of variety, he may move around to the other side of the dome. After grinding away for a while from his new position he starts in to polish the joints. Drying off the oil carefully and rubbing the dry surfaces together, he is delighted to see that the surfaces shine without an intermittent spot of dullness to mar the perfect beauty of the imaginary joint.

Now it can be readily seen that although the mechanic may have changed his position from the back to the front of the dome, the lateral relative position of the valve to the valve seat has not changed at all, and the natural consequence is that the pressure upon the valve being in both positions longitudinal with the boiler the valve has become slightly flattened fore and aft, while the valve seats have by the same cause become slightly elongated—in other words the joint of the valve remains slightly high at the sides in a line with the grinding spindle cross bar, while the seats on the stand-pipe have become elliptical with the longer diameter fore and aft.

The accompanying illustrations, though much exaggerated as to the extent of the variation, will illustrate the effect, especially in regard to the upper seat of the valve, the lower seat being also affected, although in a smaller degree. It might be added that if the mechanic retained the same position till he had completed the job the seat at the bottom of the valve would have its low place opposite that at the top, owing to the leverage of the spindle reversing the pressure upon the valve seat. Strangely enough when the mechanic gives the valve the final dry rubbing to test the bearing he is sure to turn the valve round and round, and this is the crowning error, because this gives the high places in the valve an opportunity to touch the low places in the valve seats, the result being that the whole surfaces are polished and there is every appearance of a perfect fit. Then comes the foreman to inspect the job. The fine polish strikes him favorably, but to satisfy himself further he has a trick of making chalk or pencil marks at little distances on the valve joints, and he tries that, with the result that a few revolutions rub the marks all out, as might be expected. It does not seem to occur to many that the valve does not turn around when in service, and that the proper test should be to place the valve in its working position and move it very slightly in making the final test.

We have seen how the throttle valve ought not to be ground, now let us suggest some improvements on the usual method. Erect a platform resting on the hand rails if possible with pieces running lengthwise, so that there may be an opportunity to get all around the dome. Do not throw any weight upon the valve while grinding. Lift the valve clear of the seats at every three or four turns. Do not make a full or even a half turn of the valve at any time. The shorter the movement while grinding the less likely are ridges to appear. Change the position of the grinding spindle occasionally on the valve. After the first or second application of oil and emery has been reduced by grinding, clean the joints carefully and, adjusting the valve in its place, ascertain if both joints are bearing equally on their seats. Should any variation appear, the emery should be applied to the heaviest bearing only. Avoid, if at all possible, sending the valve to the lathe. Repeated grindings change the exact relation of the axis to the periphery of the valve; and it is much easier to apply a file in reducing any shoulder that may appear above or below the joints. The same remarks apply to ridges, which can be readily removed by the application of emery cloth. When the joints are perfectly dried, pencil marks may be of some value in testing the joints, but only by carefully adjusting the valve to its working position and moving it very slightly.

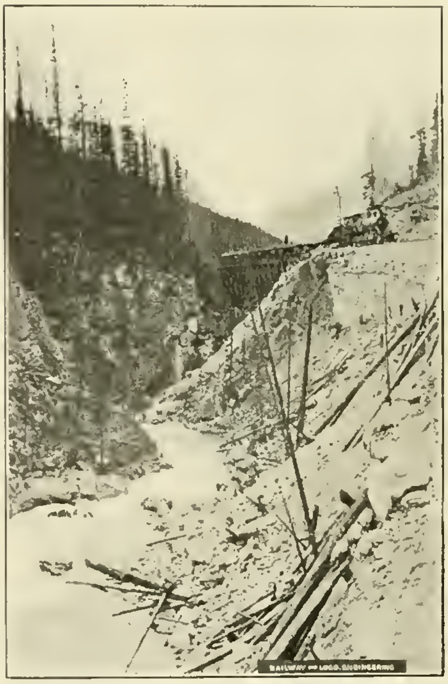
Various tests can readily be made by compressed air admitted to the dry pipe, the throttle valve being jammed tight by the spindle or otherwise. Soap suds around the joint readily show a leak, or candle or torch lights also indicate all ill fitting joints under air pressure.

As a general rule it is well to leave the throttle lever unattached until the engine is about ready. Every railroad man, from the master mechanic down, seems to have an irresistible impulse to move the throttle lever. The throttle valve joints are not benefited by being occasionally slammed to their seats with more or less violence. Engineers are really the only men who know how to close a throttle valve properly. The manipulation of the multiplex valves of a steam engine, like the keys of a musical instrument, cannot be learned in a day. The final adjustment of the throttle lever and rod and crank and valve spindle should be made by the same mechanic who ground the joints, not only that there may be no division of responsibility, but also because the valve's proper position and adjustment of clearances on the spindle affecting the same do not gain by being subdivided among a variety of workmen, but it will be found that by avoiding the evils alluded to and observing these few hints the result will be generally satisfactory, or if otherwise it might be said of the mechanic observing these instructions as was said of the western engineer who earned the trite epitaph—"He did his damnedest, angels can do no more." JAMES KENNEDY.

New York.

Patent Office Department.

The United States Patent Office is one of the most remarkable institutions in the world. In no country has mechanical invention been so warmly encouraged as it has been among the people of this land of ours. Governmental supervision has been, on the whole, eminently satisfactory, and it is a marvelous sight to examine, however briefly, the models on exhibition in the Patent Office at Washington. In no other department of human endeavor does the mercurial ingenuity of the human mind appear in such concrete multiform expression, and in no form does it appear with such marvelously multiplex results. Had King Solomon looked at the segregation of mechanical wonders gathered at Washington he would have paused before uttering his strong statement that there is nothing new under the sun.



ON THE BIG HILL, CANADIAN ROCKIES.

In the section which might be allotted to the mechanical contrivances invented to facilitate the ever-widening domain of railroad transportation, it is a remarkable fact that a larger number of inventions relative to the mechanical appliances used on railways are recorded than that of any other of our industrial branches. It is our purpose to make some passing notes on the recorded devices affecting railroad appliances, and to this end we have devoted a limited space in this month's issue of RAILWAY AND LOCOMOTIVE ENGINEERING, and if it meets the approval of our readers we purpose continuing it from month to month.

It need hardly be said that it is impossible in our limited space to describe in detail the exact particulars regarding these thick-thronging improvements in the important industry to which this magazine is devoted. We know that our readers will not expect this from us, but we believe that it will be a pleasure to them to read brief notes of the salient features of the inventions affecting railways examined and approved by the Government officials entrusted with such work.

An apparatus for cleaning track rails, consisting of two brushes to be driven from a car axle has been patented by George Huff, Tropico, Cal.

A brake shoe, having a cast metal body and a reinforcing plate of tough metal with its ends bent into hooks, has been invented and patented by James R. Cardwell, Chicago, Ill.

For circumferential corrugations in the plates of the shell of locomotive boilers, a patent has been granted to the inventor, Edward Blass, Esen-on-the-Ruhr, Germany.

A railroad safety rod, consisting of a tie bar with enlarged ends and reinforced shoulders into which are fitted set-screws, with the addition of flanges secured to the body of the tie bar, has been patented by Benjamin Sargent, Rock Island, Ill.

A very ingenious automatic air-brake and car coupling device has been patented by Lewis C. Cary of Chicago, Ill. The invention consists of a pair of coupling heads, and a pair of pipe couplings pivoted to the heads and adapted to interengage and lock tightly and swing easily when the heads are coupled.

A patent has been granted to Walter H. Wilkinson, Kingston, N. Y., for an improved brake-hanger. The hanger takes the form of an adjustable bolt which, double-nutted, can securely raise or lower the brake shoe, while a lateral adjustment of a bearing block renders the brake action readily adjustable to the brake shoe.

An improvement in a railway frog has been patented by Sidney A. Anderson of Houston, Texas. The chief feature of the device provides for a bowed steel spring and attachments, acting independently of the wing rail, the effect of the action of the spring being to lessen the constant outward movement of the wing rail. The spring is composed of a number of leaves of spring steel.

A device to prevent the creeping of rails has been patented by Heinrich Dorfmuller, Aix-la-Chapelle, Germany. The device consists of a looped clamp capable of being slipped from below and wedging means abutting against a stationary part of the railway between the vertical side of the rail and the vertical inner side of a loop of the clamp.

Thomas Davies, Boston, Mass., has invented and patented a lubricator with a pump cylinder attachment for forcing the lubricant against the pressure in the storage receptacle, together with a sight feed in the outlet passages and a check valve in each outlet passage. The working parts would be less likely to get out of order than lubricators of more complex construction.

An excellent device to be used as a locomotive cellar puller has been patented by John F. Killian, Walnutbridge, Ark. It is provided with two pivotal arms with outturned ends for catching the box, with means pivoted to one of the arms for adjusting the arms and holding them in position. Power is applied to the arms by a screw provided with a threaded bar having projections to come in contact with a resisting surface.

A universal pipe-coupling device has been patented by Adolph F. Wichman and Paul Meyer, Fort Wayne, Ind. The invention consists of a tubular angle casting having upon each of its ends a taper bearing and threaded extension, a sleeve mounted on each of the bearings, and a sleeve coupling connected to one of the sleeves adapted for attachment with a pipe, and a second angle casting for connecting with the other sleeve.

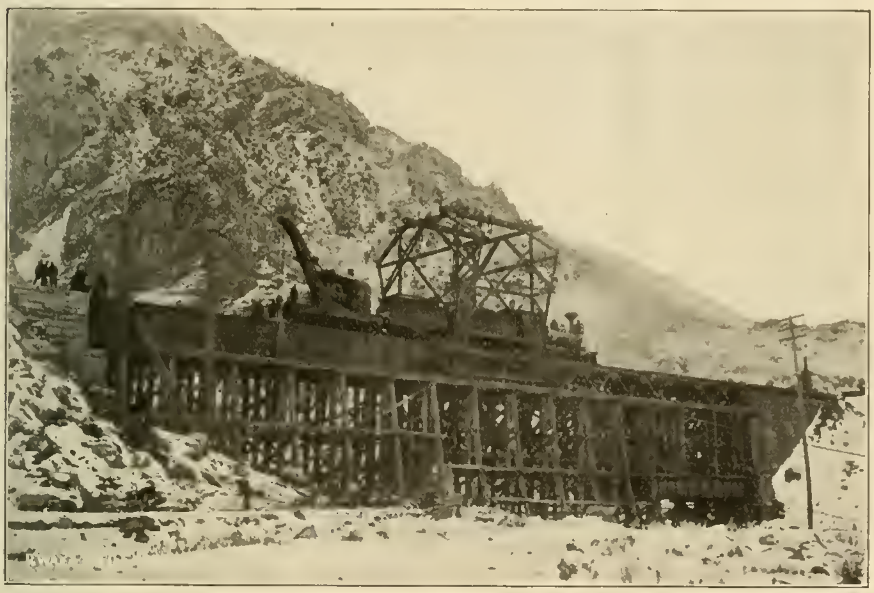
An electric railway block-signaling system has been patented by Frank E. Button, New York, whereby a constant electric current for each block is established and a plurality of signaling devices on each train, the result being that the contacts carried by the moving train in connection with two lamps indicate the condition of the block ahead as well as the block behind, in whichever direction the train may be going.

The difficulty often encountered in properly adjusting segmental metallic packing has been simplified by an excellent device patented by Frederick E. Small, of Boston, Mass. A single metallic ring composed of a number of segments of uniform shape provided with dovetail grooves and tongues are held together by two peripheral springs coiled around the metallic ring in opposite directions. It is readily adjustable to the piston and kept securely in place.

A patent for metallic packing for piston rods or movable shafts has been granted to John G. Callan, Lynn, Mass. The packing consists of helices of metallic packing composition in an ordinary stuffing box, the helices being made of thin edge-wise wound ribbon. The helices or ribbons are interlaced alternately, one having a diameter slightly larger than that of the box so as to be retained therein by its own resiliency, the other being slightly less than the rod or shaft which it surrounds.

The absolute rigidity of eccentrics composed of two separated sections approaches perfection in a device to which a patent has been granted to John W. Handley of Macon, Georgia. In addition to the studs usually attached to one section of the eccentric, Mr. Handley's eccentric is fitted with a U bolt adapted to embrace the shaft and having its arms extending through holes in one section of the eccentric, the U bolt having a projection adapted to fit in a groove or recess in the shaft to prevent slipping.

A patent has been granted to William N. Best, of the International Calorific Company of Los Angeles, Cal., covering important improvements in the construction of locomotive and other boilers. The claims embrace the construction of an air trunk immediately beneath a lining under the furnace, furnished with air openings at front and rear, leading from the air trunk into the fire box, and also an arch in the fire box furnished with openings at the rear of the arch to supply an additional quantity of air to the flame. The claims embrace appliances for regulating the size of the air passages and controlling the admission of air into the different parts of the furnace.



BRIDGE BUILDING THROUGH THE MOUNTAINS.

Speculators' News Making Bureaus.

We receive newspaper clippings for the purpose of obtaining news of railroad machinery matters and the information received is frequently valuable, but at times we find lying reports most industriously circulated. Here is a case in point, of an item which seems to have made the tour of all western papers, and is merely an attempt to float a land deal by claiming that a great manufacturing concern was likely to build works away in a God-forsaken, decaying Kansas town. If the Baldwin Locomotive Works owners wanted to build a western branch they would select some town that was not moribund, but they have not the remotest idea of making any changes. Here is the item:

"Representatives of the Baldwin Locomotive Works, of Pittsburgh, Pa., are in communication with persons in this city for a location for a western branch of their factory, which they probably will erect at a cost of two million dollars. A company here has offered the Baldwins twenty-five acres of land free and agrees to furnish free gas for five years. A company organized here with a capital stock of $200,000 has purchased 200 acres of land adjoining the city and on the line of the Missouri, Kansas & Texas Railway, and offers free sites and gas free for five years to any manufacturing concern that takes advantage of the offer. This is the offer which the representatives of the Baldwin Locomotive Works are considering."

Refined Social Distinctions.

We wonder how the social standing of railway men and their women is regulated in Victoria. The aristocratic tendencies appear to have been worked down very fine in that colony if we are to credit the *Sydney Bulletin*, which says: "If you have fifty or more cows you waltz above the chalk line in the local 'Assembly.' Below that the grading goes by tens. Mrs. Jimson, who 'milks forty,' says of Mrs. Jackson, who only 'milks thirty,' 'A very nice person, but hardly in our class.' The bottom railer whom difficulties have forced down to ten is never asked out to parties or allowed to sing at the local socials, while the unfortunate who 'only milks one' is a pariah. When a man loses his cows they scratch his name from the ball committee and send him to herd with wallaby-trappers and fern-cutters, until such time as he can patch up his damaged social prestige with a new lot of Poleys and Spots."

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The Advent of the Steam Superheater.

One of the most interesting and valuable papers ever presented to the American Railway Master Mechanics' Association was that on "The Use of Superheated Steam," by Mr. H. H. Vaughan, superintendent of motive power of the Canadian Pacific Railway, discussed at the Manhattan Beach Convention. The paper had every mark of careful, conscientious research and study. It began by outlining the history of using superheated steam as far as the facts had come to the author, but they referred mostly to what had been done abroad to obtain economy of heat from using steam that had been superheated.

The author intimated that the theoretical considerations involved in the use of superheated steam have been discussed so thoroughly in various papers and text books that any extended treatment of them was superfluous; nevertheless he gave the most succinct and comprehensive treatise on the theory of superheated steam that we have read, and the subject has been for years a favorite study with the writer.

The theory part was followed by descriptions and illustrations of three superheaters that have been used on locomotives, the Schmidt, which is in use on many locomotives on the continent of Europe, and to a limited extent on engines belonging to the Canadian Pacific, the Cole or Schenectady superheater which is in use on a few locomotives in the United States and has been specified for many others, and the Piclocks superheater, which has been applied to some German locomotives and is ready, waiting for patrons. There is no material difference in the various superheaters except in details of design. All of them take independent heat from the fire box, that is, heat which has not completed its work of evaporating water in the boiler. As we expect to illustrate and describe all these superheaters, it is not necessary in this article to enter into construction particulars.

Superheated steam was first tried to remedy the conspicuous source of waste first discovered in passing steam into a comparatively cold cylinder for the purpose of doing work by expansion. The engineers who tried to improve the Newcomen steam engine discovered that the cold cylinder wasted a considerable part of the heat energy in the steam before it performed any work, but no one could devise a means of applying a remedy for this evil until James Watt undertook the task. Having appliances for heat measurement much superior to anything previously used, Watt ascertained with fair accuracy the great magnitude of the heat losses due to cylinder condensation, and he devoted much ingenious labor to the providing of a remedy. His efforts turned mostly on methods for keeping the cylinder as hot as the steam that entered it, various forms of steam jacketing being considered the most promising and practicable solution of the difficulty.

The engineering world of a century ago readily followed the lead of Watt, and steam jacketing was generally adopted with much benefit on the slow moving engines of the period. Instances occurred, however, where the steam jacketing was defective or improperly designed, and it was found in some cases that the steam jacket was an actual source of waste since it acted as a veritable condenser instead of a heater. Thus an idol was discredited and the sceptics went searching for some new object of adoration.

Some one then proposed adding more heat to the steam instead of trying to keep the cylinders at a superficially high temperature, and the expression, surcharged steam, became familiar in engineering annals. With steam of from 20 to 40 pounds gauge pressure, the addition of 25 to 50 degrees of heat was found highly beneficial and conducive to economy of heat, without entailing much annoyance from burned packing and defective lubrication. So the practice of superheating the steam was popular for a time, but when steam pressures rose above 100 pounds gauge pressure many engineers came to the conclusion that the steam was hot enough without surcharging, and the common run of engineers and steam users refused to endure the annoyance with defective gland packing and unsatisfactory lubrication that accompanied superheated steam. Yet some firms and designers adhered to the use of superheated steam and labored to overcome the inherent difficulties, for they believed that the saving was well worth striving to secure, even if novel sources of trouble had to be wrestled with.

The exposed cylinders and the unavoidable methods of operating locomotives, where the water in the boiler is in a constant tumult, make the waste from cylinder condensation peculiarly expensive, so it is not surprising that almost every device produced for heat saving has been tried upon the locomotive. It is a low estimate to say that 25 per cent. of the heat imparted to the water in the boiler is wasted by turning again into water before it has the opportunity to push the piston. Our pioneer locomotive designers and builders were not ignorant of these facts, and various attempts have been tried to devise preventatives, among them superheating of the steam. Almost the first locomotives built in the United States, those designed by Ross Winans for the Baltimore & Ohio, with vertical boilers, had provision for superheating the steam, and Winans made claim that the arrangement was valuable in promoting economy of steam. Several smoke box superheaters were tried at various times, and William Hudson, the famous superintendent of the Rogers Locomotive Works, patented a superheater in connection with the design of a compound locomotive.

But the most famous superheater tried on American locomotives was invented and patented by Norman Wiard and exhibited working at the American Institute Exhibition in 1869. With that invention the crown sheet of the fire box was kept above the water level, and by means of an expansion trap inside the boiler a spray of water was kept playing upon the crown sheet. The enginemen called the jet the soda fountain. This superheater was applied to several locomotives belonging to the Pennsylvania Railroad Company when Frank Thomson was superintendent of motive power, and it produced superheated steam to the satisfaction of the officials of that company. It was also applied to engines belonging to the Boston & Lowell Railroad and to a steam motor run by the Worcester & Shrewsbury Railroad, the latter railroad being noted as the first steam users in this country to operate a compound locomotive successfully. In fact, the superheater was abandoned when the engine was compounded.

Those who used the Wiard superheater reported that it did all that was claimed for it, although we cannot see how there would be much superheating; but it required extra attention in making certain that the spraying device was kept in operation. We have been in communication with several men who had charge of locomotives equipped with the superheater and they say that it gave little trouble, but did not save any coal.

According to Mr. Vaughan the present development of the application of superheated steam to locomotives was due to Messrs. Garbe & Muller, of the Prussian State Railways, who in 1898 applied a superheater designed by Mr. Schmidt to two locomotives. They were so successful and the economy of fuel was so decided that the invention was steadily applied to other locomotives, and by the end of 1904 one hundred and twenty-seven superheaters were in use on the Prussian State Railways. Other railways proceeded to introduce the device and there are now over two hundred locomotives in Germany using superheaters.

The first superheater of modern make introduced into America was a Schmidt smoke box device applied in 1901 by Mr. Roger Atkinson to a Canadian Pacific ten-wheel freight engine. It proved so satisfactory that two more engines were equipped two years later. The experience with these continued to be so favorable that in 1904 twenty more engines were provided with Schmidt superheaters and twenty-one with the Schenectady superheater. Other railway companies are having superheaters applied to their locomotives, and so it may be said that the superheater is becoming the most fashionable novelty of the modern locomotive.

The writer has had considerable practical experience with steam superheaters and he is thoroughly convinced that superheated steam is conducive to fuel economy; but it is possible to pay too much for the saving effected. If the appliances used to produce superheating require so much attention that the work interferes with the service of the engine, a serious drawback is immediately established. Any improvement that will prevent a locomotive from being on the head of a train as regularly as one that does not carry the improvement, is predestined to failure. The railways of the world may be about to reap the benefits of the greatest fuel-saving invention ever applied to motive power in the form of a successful steam superheater, but it is quite possible that the device may prove as great a disappointment under the present revival as it has been in the past, when used for stationary and marine engine purposes.

A compound locomotive in first class condition saves from 15 to 20 per cent. of fuel over a simple engine of the same general dimensions. A badly run down compound locomotive uses more fuel and makes less mileage than a badly run down simple engine. Regarded in the same way, we believe it is not when the superheater is new that its merits are to be decided. Its fate will be judged when it gets old and bad water and corrosion have done their worst in careless and reckless hands. But long live the superheater, say we, if it reduces the quantity of coal that has to be fed to the fire box.

Railroad, Shipper and Consignee.

The Governor of Oklahoma has recently signed a bill concerning railroad demurrage, etc., which contains some important provisions. The new law regulates demurrage and storage charges, and provides for the prevention of delays in supplying cars to shippers and deals with the transportation and delivery of freight other than live stock and perishable merchandise.

The bill makes it obligatory on any railroad operating wholly or in part within the territory to furnish suitable cars upon the written or verbal application of any shipper, and to do it within four days, or to supply them promptly on any future date which may be specified by the shipper. Failure to comply with the law imposes a fine of one dollar a day to be paid to the shipper, and a further payment of an amount equivalent to the actual damage sustained by the shipper due to the delay.

When freight is offered, correct shipping instructions must immediately be issued by the company and also bills of lading. The freight so tendered must go forward over the railroad line at a rate of not less than 60 miles per day of 24 hours. The space of 24 hours in allowed at each point where transfer from one railroad to another is involved. Again, the penalty is one dollar per day to be paid to the shipper, and 1 per cent. per 100 lbs. per day for freight in less than carload lots, with a minimum charge of 5 cents for any one package, together with an amount equal to the actual damage to the shipper caused by the delay.

When it comes to the delivery of cars upon private tracks, delivery is held to have been accomplished, either when the cars are placed upon the designated track or in the event of such private track being full, when the cars are held awaiting orders from consignors or consignees. Similar penalties as in the previous cases are attached to this provision of the law. Consignees are given 48 hours to unload freight in 60,000 lbs. capacity cars, and 72 hours when in cars of greater capacity. After these periods have elapsed the railway is entitled to make a demurrage charge of one dollar a day for each car not unloaded. Railroads are not compelled to supply cars for future shipments to persons who have not paid the demurrage charge against them until the full amount shall have been paid. Special free time is provided for shippers to load or consignees to unload, when by reason of irregularities in railroad transportation cars are supplied or delivered in quantities sufficient to exceed the abilities of shipper or consignee to handle within the prescribed time.

The consignee who is given notice by mail is allowed 24 hours' additional free time, and when a shipper, in his bill of lading indicates the name of a person at destination it is the duty of the railroad to notify this person. If the company is compelled to unload any freight in their yards or warehouses or stations and it is not removed in 48 hours, the owner may be subject to a storage charge by the railroad, computed on the same basis as the penalty for the non-delivery of goods, and if brought to court, an attorney's fee may be collected by the road.

Maintaining Repair Shop Machinery.

The choice between having an old shop filled with modern tools and a new shop with overhead cranes, etc., and old machines was clearly and almost humorously stated by Mr. M. K. Barnum not long ago when speaking to the Western Railway Club. Under the circumstances Mr. Barnum said he would choose the old shop with the new tools.

He instanced the case of a railroad with a repair shop stocked with worn out and obsolete machinery which went ahead and bought lots of modern locomotives and then found out that the combination resulted in engine failures because the old tools could not turn out the necessary work. When things reached a cricis new machine tools were bought and the old ones retired. This resulted in an increase of 50 per cent. in the output of the shop, with only 10 per cent. increase on the payrolls. Engine failures were reduced 66 per cent., and a steady improvement all around was noticed from month to month.

Another picture he drew was that of a road with an old shop with only 21 pits, but it turned out from 45 to 50 engines per month. The policy adopted was that when a new tool appeared on the market which would earn 10 per cent. or more on the investment, the old machine was replaced by the new, and though this practice necessitated the discarding of upwards of $25.000 worth of old machinery in the last few years, the result was that the shop had practically modern equipment, and it overhauls each month from 2 to 2½ engines on each pit, while many other shops only handle about half that number. The dollar and cent result of this way of working showed that the average cost of maintenance of each locomotive per year was less than $1,600, while it averaged $2,343 for all the roads in the United States for the year ending June 30, 1903.

The speaker gave an interesting table showing the age of tools on two representative roads, without mentioning their names. One had 36 per cent. and the other 43 per cent. of the total number of tools owned by each, over 20 years old, and one-sixth of each road's tools were over 40 years old. This table was intended to show the tenacity with which some roads hold on to and try to use obsolete machinery.

Mr. Barnum spoke of the way most roads did in the matter of maintaining shop equipment. After a shop was built and equipped it was usually operated just as it stood for 15 or 20 years, with the cost of work gradually increasing all the time. When the figure got too high the road woke up and ordered new machinery. One road recently bought $200,000 worth of new tools all at once. The better plan would have been to have avoided the large lump expenditure by buying some new machines each year and retiring the more inefficient. This plan has at least the advantage that with fewer tools to buy, greater care in their selection could be exercised and the cost of repairs kept stationary, if not actually reduced.

A "Machinery Depreciation Fund," he thought, should be started by every railroad company. Some roads apply this principle to cars and locomotives, but it could be applied with advantage to shop equipment. Five per cent. per annum depreciation should be allowed until a scrap price of ¾ of a cent per pound was reached, which would then represent the minimum value which ought to be placed on any machine. Some tools wear out much faster than others, but such an average would, in general, be found very satisfactory. The most succesful manufacturers renew their machinery once in 10 or 15 years for manufacturers of tools, etc., and cotton mills once in 7 to 10 years. Mr. Barnum, however, thinks railroad shop machinery need not be renewed quite so often.

The importance of well equipped tool-rooms in railroad shops is generally underestimated, but the fact remains that the shops which are managed best and which turn out the largest number of engines in proportion to their size and equipment are the ones which have excellent tool-rooms and first class men in charge of them.

Cultivating Snobbishness.

There are superficial conditions growing in the attitude of man to man in railroad life that is tending to corrode the spirit of friendly co-operation, calculated to produce the best results for employer and employee. The undesirable condition which is growing rapidly in every part of the country was well described in a few sentences spoken by S. W. Miller, master mechanic of the Pennsylvania Lines, at Columbus, Ohio, during a discussion at the last Master Mechanics' convention. Mr. Miller said:

"I do not believe that it is generally appreciated that, just as soon as a man is selected from the ranks and made a foreman there is an invisible barrier between him and the men who were formerly his shop mates. It is almost the same as if a brick wall had been built up between them. He does not associate with the men any more, and frequently feels that he is a little better than they, and his wife will not call on their wives, and his children will not walk to school with their children. As that goes up the line and it gets to the general foreman or master mechanic, the wall becomes higher and it becomes thicker and it becomes more difficult to discover just exactly how the men feel about things."

In spite of the boasted spirit of equality and fraternity on which the Constitution of the United States is founded, there is among our people a growing spirit of snobbishness which finds expression in the attitude described by Mr. Miller. That snobbishness emanates to a great extent from the exclusive spirit displayed from the top of the railroad organizations and has a tendency to develop a spirit of hostility that is likely to prove expensive to those who pay the salaries of high and low in railway employ. Where the nominal head of a railroad regards the mass of employees as machines of varied utility to be treated merely according to their productive worth, the spirit of the autocrat and of the tyrant will pass down through the entire system. Under existing conditions it cannot be expected that the general manager should know all the men in the employ of the company, but if he is possessed of the proper manhood spirit he will know as many of the men as possible and will indicate that the welfare of the humblest among them is as much the object of his solicitude as was the welfare of the humblest citizen of Rome to its greatest rulers. Although a railroad manager cannot become personally acquainted with all the men on a great system, yet he can display an interest in the employees at large that will cultivate the ties of harmony. When Mr. F. A. Delano became first vice-president of the Wabash, he sent out a greeting to the employees which indicated a spirit of interested friendliness that made its author a friend of every man on the road. Mr. Delano wrote:

"In the nature of things I cannot meet you all immediately, although it will be my earnest effort to become acquainted as rapidly as possible with the employees of the Wabash, as well as with the property itself and the communities along its lines." That is a manly expression of intention and is worthy of a good American. Almost the worst that can be said of the spirit of snobbishness developing in offices and shops is that it is thoroughly un-American.

President Roosevelt frequently emphasizes the American spirit in dealing with people, that might be imitated to advantage by many of our aristocratic railroad officials, and by others who are cultivating patrician pretensions. In giving advice to a young gentleman who was ambitious to become a diplomat, the President wrote: "You may have an under secretaryship, but let me tell you this: don't take it just yet. You are only out of college. Take a post-graduate course with the people. Get down to earth. See what kind of beings these Americans are. Find out from personal contact. If you belong to exclusive clubs quit them and spend the time you would otherwise spend in their cold and unprofitable atmosphere, in mingling with the people, the common people, merchants and street car drivers, bankers and workingmen."

That is the kind of advice our uppish bosses ought to take to heart. They ought to find out by personal contact with their men what is needed for the welfare of the workmen, hence the welfare of their employers. Foremen and others who pretend to be superior beings to the workmen need to be sent back to the bench and the lathe and the throttle to bring them down to earth. With the snobbish sentiment dominating a railroad there can be no harmony and no spirit of pulling together for the common good.

The American Steel Foundries have received an order from the Atchison, Topeka & Santa Fe Railway for 2,000 cast steel truck bolsters for 1,000 combination stock and coke cars to be built at the Madison shops of the American Car & Foundry Company.

There are some people who do very little with head or hands that are captains of industry with their mouths.

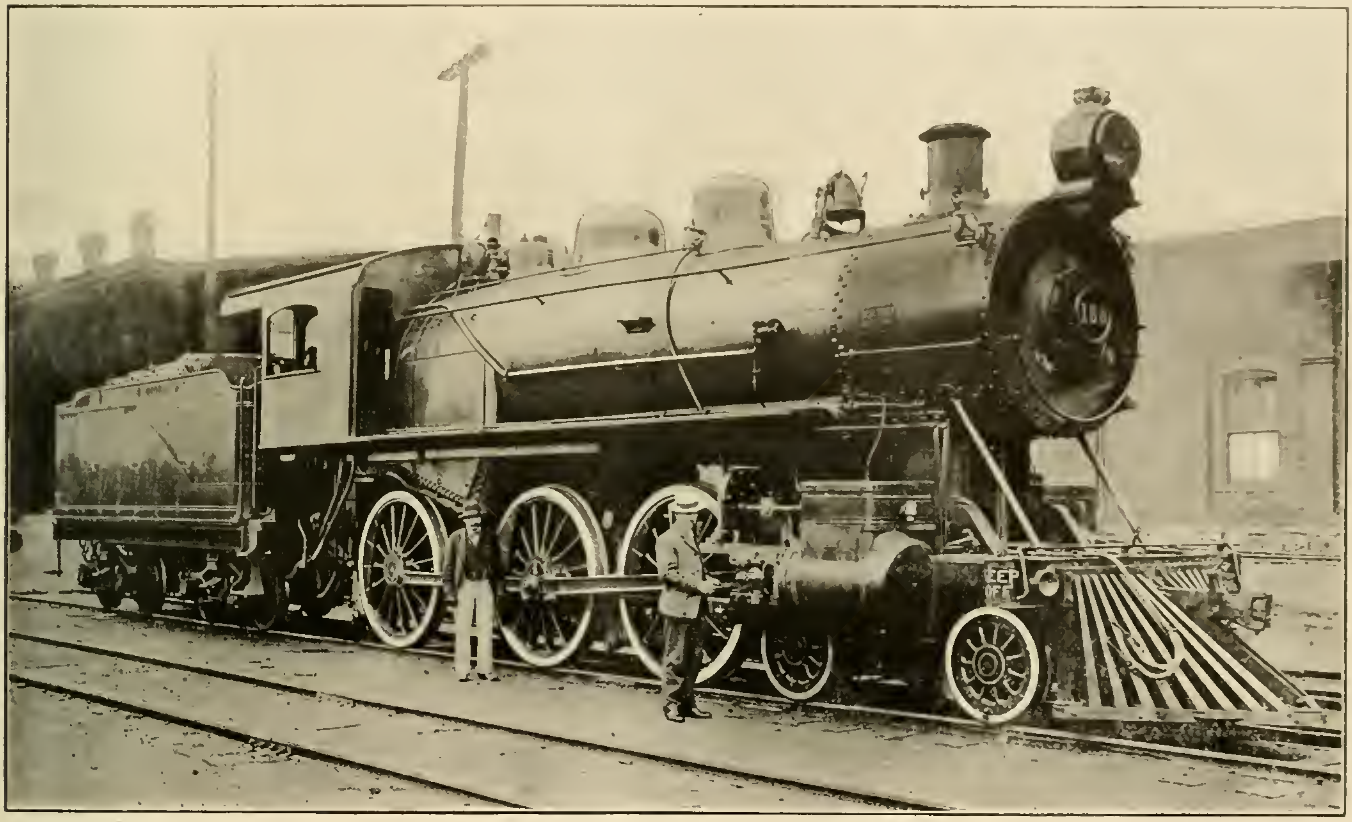
Powerful Passenger Engine for the Alabama Great Southern.

The American Locomotive Co. have just added to their long lists of engines of great weight and tractive power a new locomotive for the Alabama Great Southern, of which the accompanying illustrations give a view. These engines are so popular that we have received a special request from a high official to illustrate them in RAILWAY AND LOCOMOTIVE ENGINEERING. As will be seen, the boiler is of the wagon top variety, 66⅜ ins. in diameter, with a working pressure of 200 lbs. The fire box is 101¾ ins., with a width of 65¼ ins. The tubes are of charcoal iron with a diameter of 2 ins. and with a length of 14 ft. 11 ins.

The cylinders are 20 ins. in diameter by 26 ins. in length, with ordinary slide valves. The outside diameter of the driving wheels is 69 ins., while the truck wheels are 33 ins. in diameter, with a total wheel base of 26 ft. 10 ins. Wheels and driving boxes are of cast steel and the material generally is of the best.

A prominent feature is the large amount of heating surface, being a total of 2,811 sq. ft. The tractive power of the engine is 25,600 lbs., the weight in working order being 180,500, while the weight of engine and tender combined aggregates 301,500 lbs. The driving axle journals are 9x12 ins., while the engine truck journals are 6x10 ins. The tank is of the water bottom variety with a capacity of 6,000 gallons, and 10½ tons of coal can be carried.

The outside dimensions of this splendid type of engine are as follows: Total length of engine and tender, 55 ft. 11 ins. Height from rail to top of smoke stack, 14 ft. 11 ins. It may be added that the slide valves are of the improved Allen-Richardson balanced type with a travel of 5½ ins., the steam lap being ⅞ in.



ALABAMA GREAT SOUTHERN EXPRESS ENGINE.

J. P. McCuen, Superintendent of Motive Power. American Locomotive Co., Builders.

Experience with Superheaters.

When the subject of superheaters for locomotives was under discussion at the Master Mechanics' convention, Angus Sinclair said:

I have devoted a good deal of attention to superheated steam, and I am particularly familiar with the literature on the subject; and with that in view, I wish to express my admiration for the excellent paper which Mr. Vaughan has presented to us, and to speak about the great amount of research which it represents.

More than thirty years ago, when I was seagoing, I was connected several times with steamers that had superheaters in use. They were located in the uptake of the boilers and received the gases passing from the furnaces, so that they were subjected to a very considerable amount of heat.

The engineering world believed at the time that there was a great economy to result from the use of these superheaters; it seemed that a little extra expense made it possible to utilize a great amount of heat that otherwise would have passed through the stack. On ordinary reasoning, it seemed that great economy would result from the use of the superheater; but somehow they gradually went out of use, and I think they are very little used to-day.

In the case of the steamboats it was like what sometimes happens with locomotives. If everything went on all right, economy would result, but if the superheater would give out, and something was wrong and a few hours were lost at sea on a voyage, the expense involved by that delay was enough to overcome the advantages produced by superheating. That is the reason they have gone out of service. In fact, they were economical *per se*, but the fact they were not economical in the end was, that occasionally circumstances happened that depreciated their usefulness, and a loss of economy resulted.

You all know of things of a similar nature happening in locomotive practice. Devices are introduced that promise great economy; and they seem to show economy at the start; but after they have been in use some time and people get careless about them, they fail to show their first favorable results and they are thrown aside.

There is a common expression that if

you will paint a smoke stack red and tell an engineer that it is going to effect an economy of 10 per cent. in fuel consumption, it will show an apparent economy of 10 per cent.; and that same thing applies to many things in locomotive service. If a man thinks that a thing will produce an economy he will do his best to work it out. It requires great discrimination to make sure you are getting economy from a thing that promises to save fuel.

One time I was invited to a test of a traction engine that was supplied with a superheater; and it seemed to me that was a very striking test. They had the means of passing the steam through the superheater or direct to the cylinders at will. They would start up with the steam, same boiler pressure and cut-off as with the ordinary saturated steam, and the motor would make about ten miles an hour. Then they would change to the superheated steam, run the steam through the superheater, and immediately, without any other change, the motor would go up to fifteen or twenty miles an hour, almost doubling the speed. I never saw anything so impressive or so convincing. That motor was kept in service for a time and was expected to do great things and effect a revolution in the application of steam to motor vehicles, yet within a few years it was abandoned and the report went out that it was no good, that it did not show any special economy.

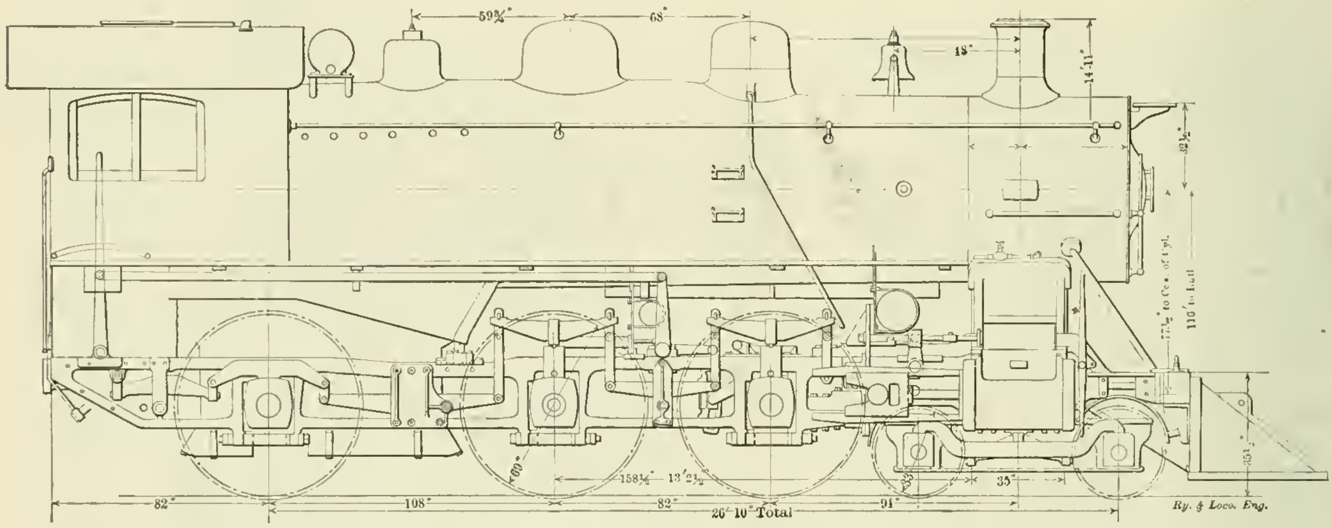
Of course, there is something to be explained about that—there is carelessness in use, or there is a letting of the the apparatus run down. Nothing will do well under persistent neglect. We are so familiar with the same thing in locomotive practice that we can easily understand how the deterioration of the apparatus will vitiate its usefulness. We have seen compound locomotives go into service that certainly gave an economy of 20 per cent., and after the engine was running for a year or two the economy would be in the opposite direction. It greatly depends on how the appliance is looked after, and I think, gentlemen, when superheaters come thoroughly into use you will be able to judge of their benefit and of their real value; and in my opinion you will find that the test of service is the real test to show whether you have a good thing or not.

Kar Koat, the New Paint for Steel or Wooden Railroad Cars.

A great many people have been wondering what the word "Tockolith" means and what is the substance for which it evidently is the name. We are pleased to inform our readers that it is a high grade of waterproof and rust-resisting coating material which is used on roofs of buildings, on steel structures and for the outside covering of steel cars.

"Tockolith" is a new thing as far as the railway world is concerned, and one of the merits which it possesses in the eyes of railroad men is the fact that it is made with a special oil which has the inherent property of drying rapidly without the addition of any "drier," and the oil itself is waterproof. It is stated upon good authority that a freight car coated with this materials is ready for service inside of eight hours.

The first coat dries in three hours, after which the second coat can be applied. The second coat recommended by the makers of "Tockolith" for use on steel cars is their No. 49 "R. I. W." paint. This last mentioned paint is made in three tints, black, brown and maroon. The word "Tockolith" and the initials "R. I. W." are derived from two features connected with the paints for which they stand. The Toch Brothers, of New York, make the colors, and the first few letters of the firm name combined with the latin word *lithos*, meaning a stone, convey in a general way the idea of the stonelike or hard mineral surface which "Tockolith" gives. The letters "R. I. W." are the initial letters of the words "Remember it's waterproof," and this has a reference to the quick drying waterproof oil used in its make-up. This firm refers to the mineral paints used for railroad work by the phonetically spelled words "Kar Koat," but with all the more or less obscure allusions suggested by the names used, the one feature which they desire to stand out clearly in the minds of railroad men is the claim that they make of producing a rust-resisting waterproof coating for steel cars that will not crack or peel off and that is capable of resisting the corrosive effects of the aqueous liquors of coal.



SECTION SHOWING CYLINDER ARRANGEMENT OF ALABAMA GREAT SOUTHERN ENGINE.

We are not specially advocating the use of this paint, but in looking over the broad and comprehensive claims made by the manufacturers, we believe it would be real economy for railroad companies to give the matter of paint specification for steel cars the closest attention, as it is a subject of the greatest importance, *not to those who build the cars*, but to those who have to use and maintain them.

Since H. L. Aldrich obtained control of the *Boiler Maker*, we have noted great improvement in the publication, and it has become one that thoroughly deserves the support of the whole boiler maker fraternity. The articles and illustrations are of uniform high quality, and the paper is calculated to keep its readers thoroughly well-informed on everything pertaining to current boiler making matters.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. When a student wishes to receive a private answer, he is reminded that it is usual to send a stamped envelope for the return letter. We will be glad to answer any question relating to railway matters, but prefer that they be suitable for our question and answer department. All letters intended for Our Correspondence School ought to be addressed to Department E.

Our Lessons.

The interest in the questions and answers stimulated by our Correspondence School is bringing us a great increase of letters of inquiry which displays ambition and enterprise on the part of the writers. Among the letters we receive are some that give no address, and that sometimes from writers who say that they are old readers of the paper. That may be so, for there is no fathoming the stupidity of some people; but every intelligent reader understands that all letters to editors sent without name and address go straight to the waste paper basket.

We receive numerous letters urging us to hurry forward parts of the lessons we have not yet reached, and from others asking us to give answers to questions submitted by the officials of certain railroads. In cases of this kind we must be left to act according to our own judgment, as to what is likely to be most helpful to the greatest number. We possess quite a collection of pamphlets containing questions for operating, mechanical and air brake examination for trainmen, but they do not differ materially from the code we are publishing. All of the pamphlets will be carefully examined and the questions checked off, so that we may know if any important questions have been missed by the compilers of the Vanderbilt code which we have nearly completed. If anything of value has been left out it will be published in our course.

Our intention is to give instruction of an elementary character, but it is possible to send us questions that every sane person ought to answer for himself without writing them down, putting the paper into an envelope and sending it through the mails. Many such questions have a family resemblance to the schoolboy's question, "What is a horse?" and the answer, "An animal with four legs, one at each corner."

Here are a few bona fide questions that we treated with silent contempt: "Why does water not run up hill? What is a consolidation engine? Is it the same as a compound? How do you figure per cent. of anything? Why does fire burn? What is the meaning of the word idiosyncrasy? My friend —— says I am what an auger makes, and laughs; where is the joke?"

We do not undertake to answer questions on things that ordinary vision ought to teach; we do not incline to save readers the trouble of consulting a dictionary or a school arithmetic, and we do not pretend to inspire common gumption.

High Speed Brake.

(Continued from page 318, July issue.)

64. How much pressure is carried in the train pipe when using the high speed brake?

A. One hundred and ten pounds is generally adopted as the standard train line pressure in high speed brake service.

65. What changes are necessary in the usual quick action car equipment to convert it into a 'high speed brake?"

A. An additional attachment to the brake cylinder by pipe connections of the high speed automatic reducing valve.

66. What parts are necessary to change the engine and tender equipment to the "high speed brake?"

A. A high speed automatic reducing valve for the tender brake cylinder, another for the driver brake and truck brake cylinders, one reversing cock and the 90 pound and 110 pound feed valve attachments, a Siamese fitting and second pump governor top.

67. At what pressure will the auxiliary reservoir and brake cylinders equalize with an emergency application using the high speed brake?

A. With a 7 in. piston travel the equalized pressures will be about 86 pounds.

68. Explain in a general way the operation of the high speed reducing valve.

A. The valve consists of a piston and stem whose downward movement is regulated by the adjusting spring. A small slide valve with a triangular escape port is attached to the upper side of the piston. If the adjusting spring is set at 60 pounds, and an emergency application of the brake be made, the piston will descend when 60 pounds has been accumulated in the brake cylinder, and the apex or smallest part of the triangular port will permit brake cylinder pressure to pass through it and escape to the atmosphere; as the brake cylinder pressure reduces, the piston will gradually move up a larger part of the triangular port, thus increasing the opening for the escape of brake cylinder pressure to the atmosphere. When the brake cylinder pressure has blown down to 60 pounds, the port will be closed, shutting off further escape of brake cylinder pressure to the atmosphere. In service application, the larger portion of the triangular port will permit brake cylinder pressure to escape to the atmosphere when 60 pounds has been accumulated in the brake cylinder, thus blowing down the pressure quickly and preventing more than 60 pounds being accumulated in the brake cylinder in service application.

69. If a train with a high speed brake should pick up a car not equipped for high speed brake service, what should the engine man do?

A. Usually a small safety valve is supplied by yard inspectors for cars not equipped with the high speed reducing valve. Sometimes, however, the car in unusual cases is permitted to go without either a reducing valve and without a safety valve, care being taken by the engineer in service applications of the brake, not to slide the wheels.

70. When a car that is equipped with an ordinary brake is coupled to a train using the high speed pressure, what must be done with this car to run it with the high pressure?

A. This is answered in the preceding question.

71. How does the pressure developed in the brake cylinder, with the high speed brake, with a given reduction, compare with pressure developed with the same reduction made with the ordinary quick action brake?

A. If reductions less than that which will cause a full application of the low pressure brake be made, the resultant brake cylinder pressures will be the same with the low pressure brake as with the high pressure brake; however, if the reduction made should do more than produce an equalization of the low pressure brake, the cylinder of the high pressure brake would have the highest pressure, and would give a greater braking force.

72. How many full applications with the high speed brake can be made before recharging is necessary, and have left as much pressure as is used with the ordinary quick action brake?

A. The high speed brake will usually, with proper piston travel permit of two full service applications and releases and still have sufficient pressure reserved to make an emergency application as great as the 70 pound brake would give when fully charged.

73. How should the engine truck or driver brake be cut out?

A. A suitable arrangement of cut-out cocks should be supplied which will permit of the auxiliary reservoir being cut out when the brake cylinder is cut out, thus preventing the brake left cut in having too large an auxiliary reservoir capacity, which would tend to slide the wheels when brakes were applied.

74. How should both the driver and engine truck brakes be cut out?

A. By the stop cocks arranged for that purpose.

Straight Air Brake.

75. On what is the straight air brake designed to operate, and what extra parts are required on engine and tender?

A. The straight air brake is designed to operate on the engine and tender alone, and not on the cars of the train. To operate the combined automatic and straight air brake, extra parts as follows should be supplied: Reducing valve for the straight air system, set at 45 pounds; an engineer's straight air brake valve; a double seated check valve for the driver brake cylinders; a double seated check valve for the tender brake cylinder; a safety valve, set at 53 pounds, one for the driver brake cylinders and one for the tender brake cylinder; and a straight air brake hose connection between the engine and tender.

76. What should be done to release the brakes when they do not release with the handle of the straight air brake valve in release position?

A. The automatic brake valve handle should be placed in full release position, then returned to running position.

77. What pressure should be developed in the brake cylinder by this brake?

A. About 45 pounds, as indicated by the adjustment of the reducing valve in the pipe between the main reservoir and straight air brake valve.

Miscellaneous. (Air Brake.)

78. Where are leaks in the train pipe most likely to occur?

A.—First, at the hose couplings; second, at the unions in the train pipe; third, through porous hose; and fourth, at the exhaust port of the triple valve.

79. What is the leakage groove of the brake cylinder for?

A.—To permit pressure going to the brake cylinder at the improper time to escape to the atmosphere, past the brake cylinder piston, instead of accumulating there and pushing out the brake piston and applying the brake.

80. As a rule, how great a reduction of train pipe pressure is necessary to insure the brake piston moving out beyond the leakage groove?

(*Continued on page 371.*)

Questions Answered

POWER OF BALANCED COMPOUND LOCOMOTIVES.

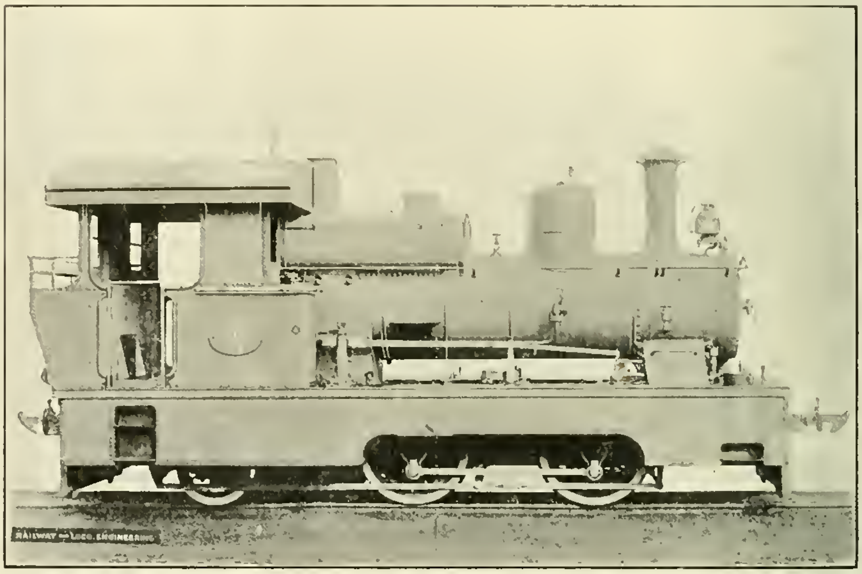
(76) A. B. S., Chicago, writes:

I am one of a small band of railroad men who have joined together for the purpose of helping each other to learn things that intelligent railroad men ought to know. We have been discussing your Correspondence School Course, but it does not last us a whole month, and we take up other subjects between times. Lately we were trying to figure out the power of a balanced compound locomotive, but we are not certain about the process. We have considered the rule in your book for figuring the power of a simple engine, but it does not seem to come out right. For an engine with cylinders 17x28x32 ins., we first squared the diameter of the high pressure cylinder, multiplied by the stroke and by 85 per cent. of boiler pressure then divided by 76, the size of the driving wheels. The low pressure cylinder power we figured out in the same way, and added the two sums together for the total tractive power. The total looks too high, so we decided to refer to you. A.—The method of calculating is all right except that the boiler pressure is too high. Instead of using 85 per cent. of the boiler pressure for the high pressure cylinder you ought to take ⅔ of the boiler pressure, and for the low pressure cylinder ¼ of the boiler pressure. That will give you the tractive power.

WHY THE UPPER PART OF A CYLINDER WEARS FASTEST.

(77) M. A., Scranton, Pa., writes:

Has any explanation ever been made of why the upper part of locomotive cylinders wear more rapidly than the bottom, which naturally should wear faster, since it has to carry the weight of the piston? A.—We have heard and read a great many finely worked out theories about the thrust from the main rod putting more pressure on the top than on the bottom of the cylinder, but we never could see how the upper acting thrust passed the guides. There being a larger mass of cast iron on the top than on the bottom of the cylinder that part is probably softer than the bottom, and so wears more rapidly.



GERMAN SWITCH ENGINE WITH AUTOMATIC BELL IN FRONT OF SMOKESTACK.

SEAMLESS FLUES.

(78) Purchasing Agent, Chicago, writes:

A man who has locomotive boiler flues for sale, called on me yesterday, and he gave me a talk about "seamless tubes," as he called them, that has left me confused. I have decided to ask you in confidence if all flues are seamless, as this man insisted? A.—The man who asserts that all flues are seamless is trying to deceive some one. The old way of making a flue was to take a strip of iron about the length required for the flue, heat it in a furnace, bevel the edges, then weld them. That was a lap welded flue. Another way was to make the weld without thinning the edges, when it was bolt welded. The modern way of making seamless tubes is to take a billet of steel, make a hole in it, and by successive operations draw it out into a flue. That is a seamless flue. The United States Government and many other boiler makers preclude welded flues for cause, which induces agents for the inferior kinds of flues to lie about them and say they are seamless when they have been welded.

BRAKE PIPE.

(79) O. J. R., Worcester, Ohio, asks: Which is right, train pipe or brake pipe? I see that both are used, but which is right? A.—Air brake men generally agree that "brake pipe" is proper when applied to that pipe part of the air brake system which connects the engineers' brake valve with the brakes of the train. This name was applied by Mr. Westinghouse to his first form of straight air brake, and was extended to his automatic brake. Carelessness, however, on the part of air brake men has permitted the improper use of "train pipe' when speaking of this part.

ADJUSTING DUPLEX GOVERNOR.

(80) B. R. H., Utica, N. Y., writes: How do you adjust a duplex air pump governor with the improved feed valve attachment brake valve? Which governor do you screw down to increase your main drum pressure, and are they supposed to be placed in any special position? If so, please publish in the journal how I would adjust the same to increase my pressure in either way for train line or main drum pressures and if governors should be set in any particular way. Advise in the journal as I have had some peculiar experience with same which I will write and explain after reading your answer on same. A.—We assume that the case is one of duplex main reservoir control, where the high pressure or 110 pounds main reservoir governor top is connected direct to the main reservoir connection on the brake valve, and the other governor top set for 85 pounds is connected to the underside of the brake valve. The low pressure head limits main reservoir pressure to 85 pounds when the brake valve handle is in full release position or running position. However, when the handle is on any other position than these two, there is no increase of pressure in port in the brake valve to which the low pressure head is connected, the same being cut off and out of commission; consequently, this low pressure head does not functionate, and the pump will not stop until 110 pounds in the main reservoir is reached, when the high pressure, direct connected, governor head is brought into operation. Train line pressure is governed by adjustment of slide valve feed valve as usual.

See illustration and description of this device in May issue.

Birth of Our Railroad System.

Early in the year we enjoyed the privilege of listening to an address—Some Lessons of Our National and Railroad History—delivered by Mr. William C. Brown, vice-president of the New York Central, before the Railroad Young Men's Christian Association. We were struck at the time with the numerous valuable and interesting points made by Mr. Brown, but it was not till the beginning of July that we succeeded in obtaining a copy of the paper. Here are interesting extracts:

"I desire to call up some event in our national life and railroad development, interesting and singularly similar in their development and results.

The nation was fifty years old before the construction of its first railroad was undertaken.

The Declaration of Independence was signed, and the old Liberty bell pealed out the glad tidings to the people of Philadelphia and to the world on July 4, 1776. A half-century later, on July 4, 1826, the Hon. Charles Carroll, of Carrollton, at that time the last surviving signer of that immortal document which marked the birth of this nation, drove the first spike of the first rail of America's first railroad.

Fifty years of national progress and development may have given some slight conception of the sublimity, of the tremendous significance and importance of the event in which he had acted so prominent a part a half century before, but certain it is that neither Charles Carroll or any other person in the vast concourse who witnessed the laying of that first bar of railroad iron, realized that the venerable statesman was performing for the business and commercial world, yea, for the religious and the educational world, a service similar in importance, and as far reaching and beneficent in effect, as when he with fifty-four other patriots and heroes affixed his name to the grandest, most sublime declaration of principles ever conceived by the brain or penned by the hand of man.

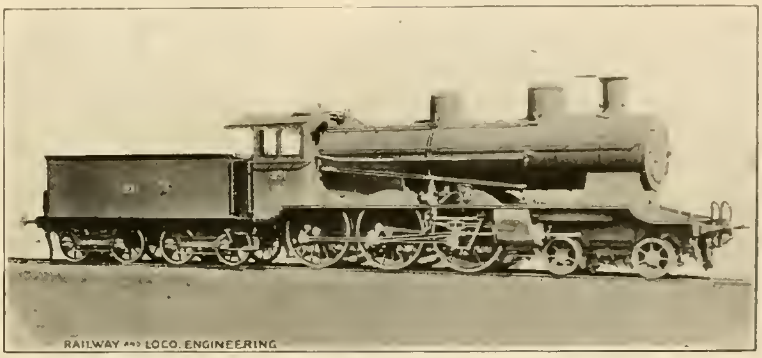
It is safe to say that no other man has ever participated in two great focal events so momentous in importance, so full of far reaching, tremendous significance for all mankind, not in our country alone, but to the uttermost parts of the earth and to the end of time.

The first was the birth cry of a new nation "conceived in Liberty and dedicated to the proposition that all men are created equal." To its maintenance was pledged the lives, the fortunes and the sacred honor of the immortal band of patriots who affixed their names to that sublime declaration of principles and of the colonies they represented, and in eight years of as heroic struggle as history records that pledge was gloriously and triumphantly redeemed.

Save, and except the birth of the Christ child in Bethlehem's manger, no event in all the ages has ever meant so much to humanity. It changed a nation of subjects into sovereigns, and lighted on this western continent a beacon light of liberty which has been, and always will be, an example and an inspiration to the oppressed of every nation of the earth. In confirmed to our fathers, to us, and to our children's children unto remotest generations, the precious heritage of liberty and equality, and made simple American citizenship a priceless birthright.

The latter event, separated from the former by the span of fifty years, made possible the marvelous development and progress of the last half of the nineteenth century—development which exceeded that of any previous ten centuries in the history of the world—and which added a hundred fold to the value of every American birthright.

From this small beginning, within the memory of many living to-day, this progress, the development of the railroad has been the story of the onward, upward, resistless march of a mighty nation. The church, the schoolhouse and the railroad have for three-quarters of a century formed the advance guard of settlement and civilization.



SIMPLON EXPRESS TRAIN LOCOMOTIVE.

Pipe Hand Rail Joint.

A handy sort of joint which can be used in making pipe hand rails for stairways is to be seen at the front door of the Wilmington shops of the Pennsylvania Railroad. It can be made of cast iron or of a cheap grade of brass, according to the taste and fancy of the maker. They can be made of any size may run and are also available for use on ornamental pipe line fences in or about shops or on station grounds. Some such arrangement as this joint is adaptable as a standard for railway ornamental fence or hand rail work.

The joint is, briefly, a socket, threaded to receive the end of a length of pipe, with a hemisphere attached. The combination is made by putting the flats of two hemispheres together and driving a rivet through so as to make them into one ball. The use of these joints does away with pipe fittings and the bending of pipe ends. All the pieces of pipe are cut to proper lengths, a few threads cut on the ends of each, and they are ready for use. The combination joint, which is strengthened on the outside by a rib in each case, is practically capable of being put together at any angle, and in this way gives an appearance of uniformity which odd pipe fittings and pipes bent so as to enter right angle fittings cannot have. In Fig. 5 the various combinations are shown, the numerals used in it refer to the figure numbers of the sketches. The combination hand rail joints are easily made, they can be readily used, and, in a word, they seem to fill the bill when pipe hand railing has to be put up.

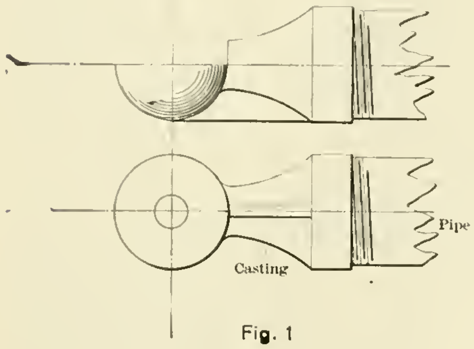


Fig. 1

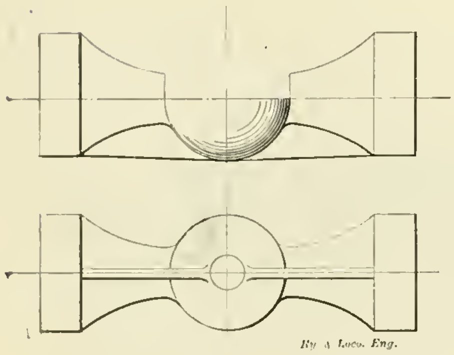


Fig. 2

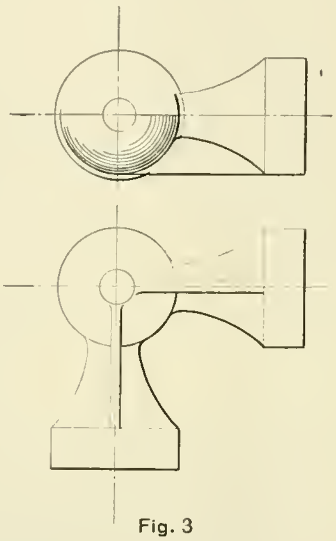


Fig. 3

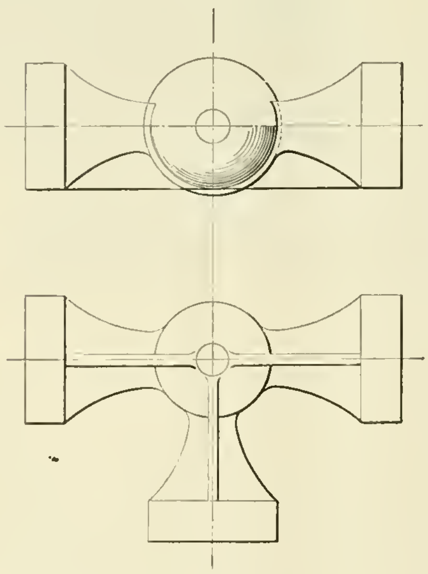


Fig. 4

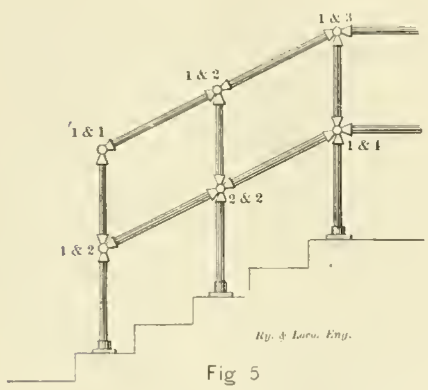


Fig 5

SECTIONAL VIEWS OF PIPE HAND RAIL JOINT.

and the proportions of the parts may be arranged as desired by the designer.

The series of outline sketches which we give show the general arrangement of the hand rail pipe joints used with ordinary two-inch pipe. There are in all four patterns, and these, in combination, will make stair rail joints for any kind of stairway, broad or narrow, steep or easy. These joints adapt themselves to any angle at which the stairs

Iron and Coal.

Man's consumption of iron—taken externally—is steadily increasing. It has been calculated that the amount required for each man in the first centuries of the iron age was much less than a pound per year. Not everybody had an axe, and patricians alone carried shields. Even four centuries ago the requisition did not exceed in the most civilized countries 10 lbs. a head a year. It appears to have been at something like that rate when the English colonies were founded in North America. At the present time in the United States it has reached an average of about 400 lbs. a year for every man, women and child in the land, and the demand is increasing with great rapidity. It seems likely that unless the alloys begin to supersede the use of steel in some machinery a ton a year of steel will be the annual allowance for every man. The output of coal has increased on parallel progressive lines. In the seventeenth century the annual output of the world was probably only 100,000 tons, or perhaps a pound a head for Europeans. At the present time the total production of Europe and North America amounts to an average of at least two tons per unit of the population, and this consumption is also increasing.—*Scottish-American.*

Considerable interest is being manifested among railroad men in the methods of heating and ventilation in roundhouses. Steam pipes still exist in certain quarters, but the danger from breakages renders their use undesirable. The B. F. Sturtevant Co., of Boston, has perfected an improved method of circulating hot air by a fan so placed in connection with a mass of heating surface that the air may be forced through ducts to all of the pits and thereby facilitate the melting of the snow and ice, and rapidly d[illegible] running gear. Among recently constructed roundhouses so equipped are those of the Canadian Pacific Railway Company.

New buildings are being erected by the Rome Locomotive Works which will be furnished with new and modern equipment. A great increase in the working force is expected.

Air Brake Department.

CONDUCTED BY F. M. NELLIS.

Westinghouse Compound Air Pump.

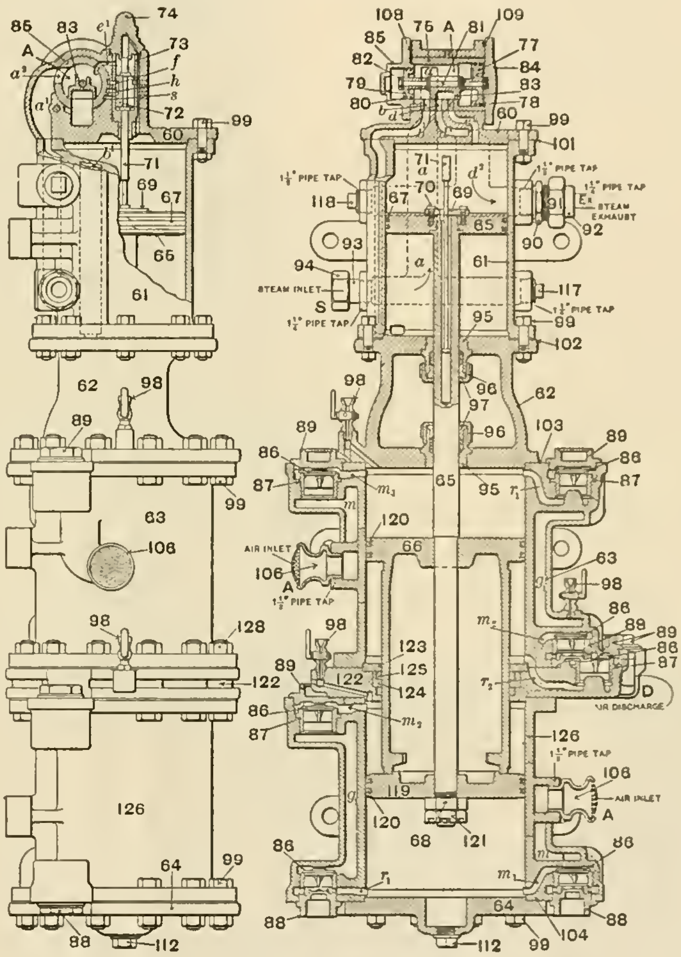
This, as its name implies, is a compound pump, there being two stages of air compression from the time air is taken into the pump until delivered to the main reservoir. By referring to the accompanying illustration it will be seen that the pump consists of three cylinders placed in vertical tandem, the two lower ones being joined by a thin center piece 122, constituting the air end of the pump, and these are connected by a center piece 62 to the steam cylinder.

The upper and lower air cylinders are of the same diameter, 11 ins. with a 12-in. stroke, each having a piston 66 and 119 respectively, connected to the piston rod 65, which is actuated by the steam piston. These two air pistons are further connected by a drum, of smaller diameter than the inside diameter of the air cylinders, in such a manner that the two pistons and drum form a sort of spool. The center piece 122 fits closely about the spool body and has packing rings 124 and 125 to prevent the passage of air from one cylinder to the other, past the trunk of the drum, or spool.

On the down stroke, air is drawn through the upper air inlet on the left-hand side of the cylinder. It passes through the air inlet 106, passage *m*, receiving valve 86, and passage *m1*, to the lower pressure volume above the piston 66. When the piston reaches the lower limit of its stroke and moves up, this air is compressed until the upper discharge valve 86, on the upper right-hand side of the cylinder, is raised, then the air is forced through port *r1*, discharge valve 86, passage *g1*, receiving valve 86 and port *m2* to the annular cavity between the drum portion of piston 66 and cylinder 63. Since this volume is much smaller than the low pressure volume, the air is being compressed through this passage from the low pressure to the high pressure volume, until the piston reaches the upper limit of its stroke, the air in the low pressure clearances, passages and high pressure volume, has reached the intermediate pressure of approximately 40 pounds.

During the down stroke this intermediate pressure air is being compressed until it raises the final discharge valve 86, when it passes through port *r2* and the discharge valve to the "air discharge" orifice in the center piece 122, thence to the main reservoir.

This same operation occurs in the lower cylinder when the piston goes in the opposite direction from that just described, and as corresponding passages are designated by the same letter the operation can be readily followed.



WESTINGHOUSE COMPOUND AIR PUMP.

This compound pump is equal to the 11-in. pump in air compression capacity, and has a steam consumption of an 8-in. steam cylinder. By compounding the air end, a much smaller steam cylinder can be used to operate the pump, thus causing a marked economy in steam consumption.

New Air Brake Association Questions and Answers.

This new, up-to-date, complete treatise on both the Westinghouse and New York systems, bound in one book, and consisting of nearly 400 pages, 2,000 questions and answers, and 200 new, beautiful illustrations, prepared specially for this purpose, is meeting with a cordial reception and bids fair to outdo all previous air brake books. It is equally good for the beginner and the advanced student. You should have a copy for examinations. Price, prepaid, leather, $2.00; paper, $1.50.

Air Brake Association Proceedings for 1905.

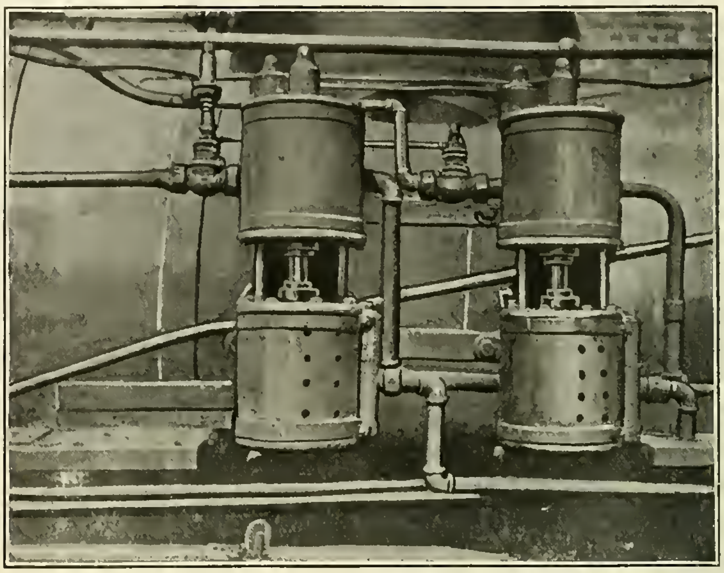
The Proceedings of the Twelfth Annual Convention of the Air Brake Association, held in New Orleans, April 11, 12, 13 is now ready for sale. Keep your air brake files complete, and don't wait until the edition is exhausted to order your copy. For sale at this office. Price, leather, $1.00; paper, 75 cents.

"World's Fair Engine" Arrangement of Air Pumps.

Am sending you a view of our "World's Fair Engine," showing how we use some of our smaller pumps in switching service, the engine being equipped similar with air pumps to the big matriculated Baltimore & Ohio engine at the St. Louis World's Fair.

C. A. Barnett,
"Frisco Line."

Monet, Mo.

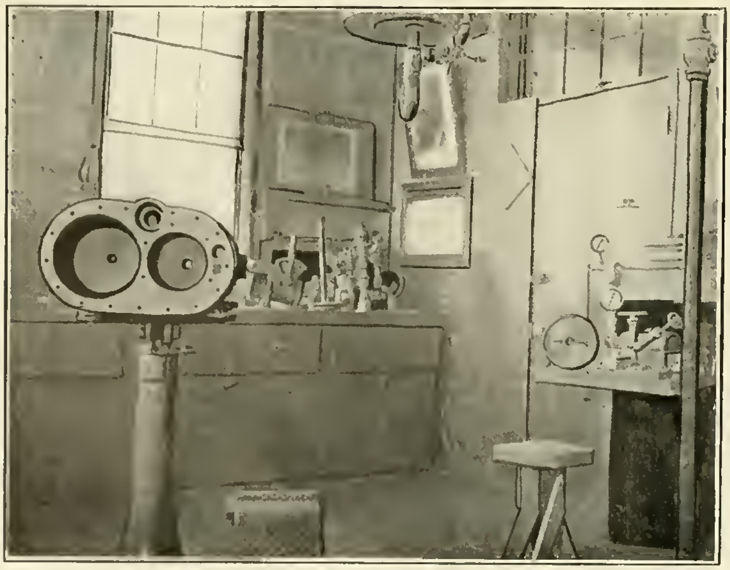


"WORLD'S FAIR" ENGINE AND PUMP ARRANGEMENT.

Devices for Air Brake Repair Room.

No. 1 shows rack for testing both New York and Westinghouse engineers' valves, also all styles of pump governors, all pipe connections are under the bench and reservoirs and pipe equal to a six-car train.

No. 2 shows our gauge tester arranged in a dustproof closet and so arranged that the bench on which tester is mounted can be drawn in and out. On top of this bench you will note three books which contain clippings from the Locomotive Engineering since before a regular air brake department was established up to the present date. Three of the *best* air brake books in the United States.



DEVICES FOR AIR BRAKE REPAIR ROOM.

Those Air Compressor Diagrams.

Editor:

Complying with your request in the May issue of Railway and Locomotive Engineering regarding your readers submitting criticisms and interpretations of steam cylinder of air compressor diagrams, would submit my guess as follows: Am of the opinion that this engine has Corliss valve gear or a similar gear having separate admission and exhaust valves.

In the first diagram, or the one representing the back stroke, I note that admission remains at initial pressure for about one-quarter of stroke and then raises slightly, this increase in cylinder pressure being due to gradually increasing load caused by the compressing of the air in air cylinder and a consequent slight decrease in piston speed. There is practically no expansion at all, the cut-off and release being almost simultaneous. The rapid release denotes a very large exhaust opening, which opening continues only for about 1½ ins. of the piston stroke and then very nearly closes, in which position it remains, always blowing slightly.

Apparently the admission valve is leaking at all times, the exhaust opening being large and free enough to accommodate cylinder volume and this leak combined. At the closing of exhaust the blow from admission valve increases cylinder pressure from an amount slightly above atmospheric pressure to about 35 lbs. at end of stroke. The blow in exhaust valve is ample to take care of this constant cylinder pressure, hence does not increase compression. The abruptness of compression line would indicate a slightly increased opening of admission valve, which slight opening continues to end of stroke, then opening fully.

I attribute the peculiar shaped projection prior to admission to the slow speed of piston at this point and to cylinder clearance. To improve the steam distribution in the cylinder, would increase air discharge valve openings, reseat or reset steam and exhaust valves, continue admission full stroke and to do away with peculiar projection at admission point would slightly delay admission.

In the second card the steam action and causes are practically the same, only that compression is too early and increasing load greater in forward stroke and cut-off and release are earlier in back stroke.

It would seem that there would be a very trying strain on crank shaft and its bearings, inasmuch as during a space of about ¾ in. in stroke the opposite engine must perform all the work and the back pressure of the partially compressed air would serve to give a backward kick to piston relieved of nearly all steam pressure.

E. O. Palmer.

Bloomington, Ill.

Some Practical Observations.

When taking charge of a locomotive the engineer and fireman are instructed to start the pump slowly with drip cocks open to carry off condensation, and to run the pump slow till the pressure is at least twenty pounds in the main reservoir. This is to prevent damage to heads, piston rods and reversing stem, by piston being thrust up and down in cylinders before there is any pressure to cushion it, and while the pump is running slow, to oil the air end, by putting a small quantity of valve oil in the oil cup, and open cup on downward stroke. The air being drawn in on this stroke will take in the oil and spray it around the walls of the cylinder. If the oil is put in when the pump is at rest, it runs down one side of the cylinder and lies on the piston until the pump is started, and is then carried to the top discharge valve, saturating it with oil, leaving part of the cylinder dry, and after a time we find that the dust which we pump in with the air accumulates on the discharge valve and its seat, and, when we wish to repeat the oiling, that, if there is any pressure in the reservoir, it will flow back and we cannot get oil into the pump until we drain the main reservoir. We also find that too much oil in the air cylinder leads to pump heating, because it clogs the discharge valve, and the main reservoir pressure spoils the upward stroke of the pump by filling the cylinder from the main reservoir instead of taking it in from the atmosphere. When testing brakes at terminals, it is good practice to always release in running position, as the inspector will have an opportunity of finding any brakes that are hard to release, due to dirty triples, leaky or bad fitting rings, and the brakes that can be released in this position at a terminal will readily release in full release position when on the road. We find a large proportion of our defective brakes in this way, and we are of the opinion that since we adopted this method we have reduced the number of slid flat wheels on our cars. In the winter season we experience a great deal of trouble with leaky hose gaskets. The hose seems to freeze and refuse to bend, losing all their elasticity, and the only relief they have when drawn out or compressed is a "hinge-working" as the gasket joints, which causes them to leak and give no end of trouble. This is the season of the year when the patience of the engineer and the capacity of the pump are tried severely.—*Extracts from a paper read before the Canadian Railway Club by W. S. Blyth, Trav. Engr. Canadian Pacific Ry.*

Increased Dividends.

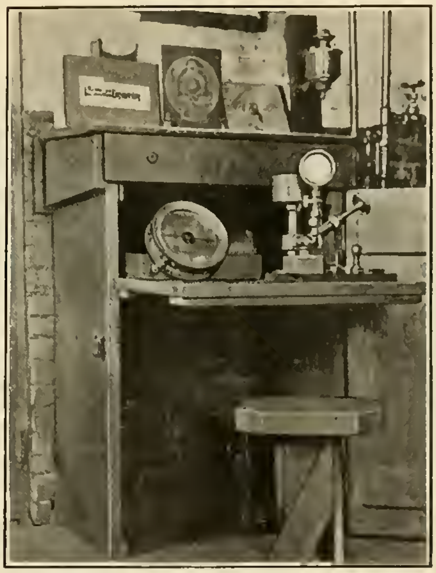
It is stated on reliable authority that the annual report of the American Locomotive Company will show approximately $1,500,000 charged off, after the payment of the preferred stock dividend, for extraordinary improvements. The dividend on the common stock is 8 per cent.

(*Continued from page 366.*)

A.—On a train of a few cars, about 5 to 7 pounds is sufficient; but on a long train 10 or 12 pounds will be required. This depends also upon the condition of the triple valves and the condition of the equalizing piston in the brake valve.

81. Should the brakes be tested before leaving the terminal?

A.—Yes, first by the yard testing plant to determine the proper piston travel and condition of the brakes, and



DEVICES FOR AIR BRAKE REPAIR ROOM.

second by the engineer after coupling up to be sure that all angle cocks are open and that the brakes are operative.

82. What is the proper brake cylinder piston travel on freight cars?

A.—From 5 to 7 inches is the accepted standard travel.

83. How is the slack taken up on a tender?

A.—With a brake of the equalized type, a dead lever is supplied for taking up the slack. On other types, the slack may be taken up at points where holes are provided for connecting rods in the brake rigging. Some riggings are supplied with turn buckles for this purpose, but the practice is not considered the best for tenders.

84. If a brake is stuck and cannot be released from the engine, how would you proceed to release it?

A.—Open the "bleeder" cock quickly and close it quickly, thus making a sudden reduction in the auxiliary reservoir pressure which will allow the greater train pipe pressure to shift the triple from application position to release position.

85. What is the proper piston travel for passenger cars?

A.—About 6 inches standing travel.

86. If, when testing brakes, it is found that one will not apply, what might be the cause?

A.—The brake might be cut out by the cock in the cross over pipe, the auxiliary reservoir might not be charged, or the triple valve piston and slide valve might be so corroded that they will not move in response to an ordinary train pipe reduction.

87. Can a brake be operated if the retaining valve is broken off?

A.—Yes, the retaining valve is operated only to hold pressure in the brake cylinder to prevent a full release of the brake, and has nothing to do with the application of the brake.

88. With a 70 pounds train pipe and auxiliary reservoir pressure, how much of a reduction will be required to apply the brakes fully?

A.—About 20 pounds, providing the adjustment of piston travel is as it should be.

89. Has the piston travel anything to do with the pressure obtained in the brake cylinder?

A.—Yes, the longer the piston travel the greater will be the capacity of the cylinder for consuming the auxiliary reservoir pressure sent to the cylinder, and consequently the lower will be the brake cylinder pressure. The shorter the piston travel, the less will be the volume in the cylinder into which the auxiliary reservoir pressure must go, and the higher will be the brake cylinder pressure.

90. With all things uniform, what is the highest pressure that can be obtained in full service application?

A.—About 50 pounds, with the piston travel adjusted at about 7 inches travel. Emergency application? A.—About 60 pounds with a 7-inch piston travel.

91. Is a greater initial reduction required with a 50-car train than with a 10-car train?

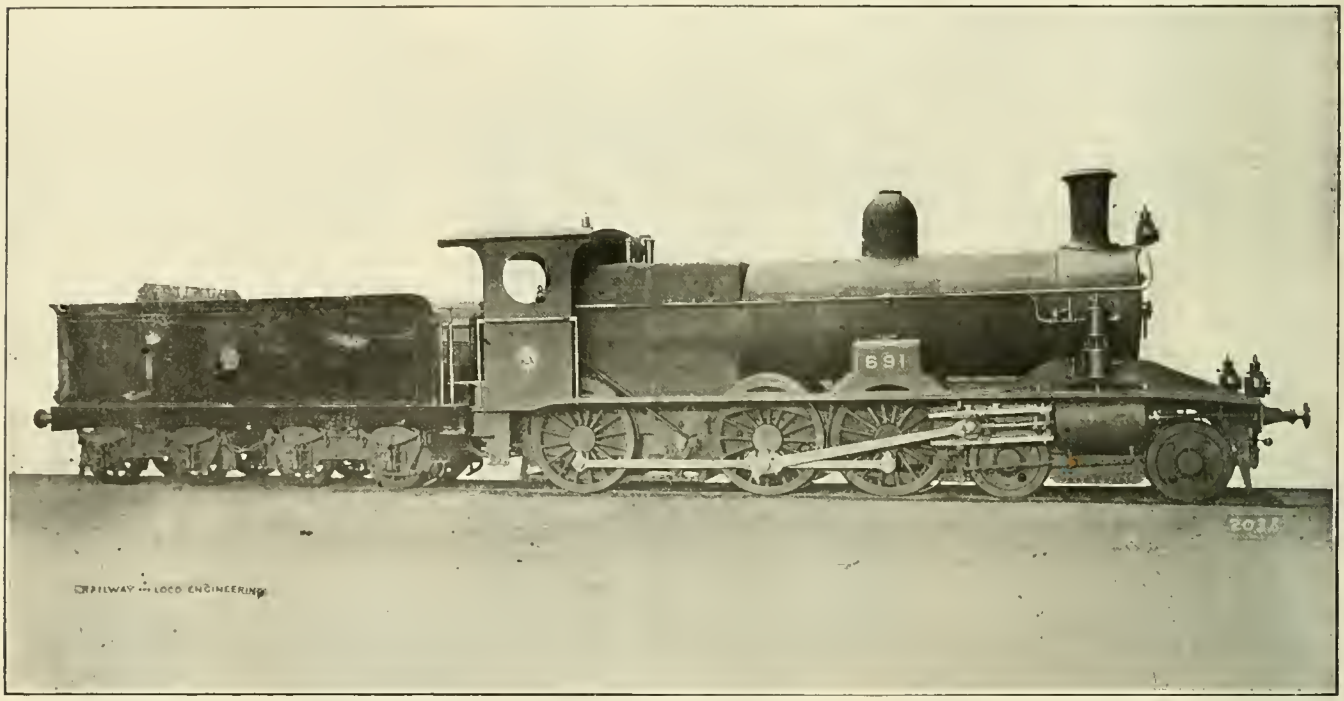
A.—Yes, if a service application be made, for the train line pressure may leak past a poor fitting ring in the equalizing piston of the brake valve and onto the top side, thus causing the piston to descend and close off the escape of train line pressure before the full reduction has been made. If the train be short, the leakage upward past the piston ring into chamber D will be less than it will be with a longer pipe, which has a greater volume and a better chance for leakage.

(*To be continued.*)

Baldwin's New South Wales Ten-Wheeler.

The Government of New South Wales, Australia, have recently placed several orders for locomotives in the hands of the Baldwin Locomotive Company, and the accompanying illustration shows one of these engines, No. 691, which has just been completed. As will be seen, the wheels are of the 4-6-0 type, and the engine has the appearance of being admirably balanced, simple and elegant in design. The weight on the driving wheels is 81,000 lbs., while the total weight of the engine is 127,600 lbs. The engine is finely adapted for the Inter-colonial goods service for which it is intended. The boiler is of Belpaire steel type, with a diameter of 58 ins., the thickness of the sheets, 17/32, are well calculated to last for many years as a working pressure of 160 lbs. The fire box is of copper, length 95 ins., width, 42 ins., depth at back 57½ ins., sloping down to 76¾ ins. at the front. The copper sheets are ½ in. in thickness. The tubes are also of copper of the wire gauge thickness of Nos. 10 and 12. The number of flues are 252, their diameter being 1⅞ ins., the length of body of boiler being 14 ft.

The driving wheels are 60 ins. in diameter, truck wheels 39 ins. in diameter. The total wheel base is 25 ft. 9 ins. The tank is extra large, having a capacity of 3,650 Imperial gallons. The cab resembles more nearly the limited British type than that of the more commodious American type, but the engine as a whole is a model of beauty in design, with the elements of simplicity and durability in a marked degree.



BALDWIN'S NEW SOUTH WALES TEN-WHEELER.

Rapid Wear of Rails.

In various railroad yards and other places where wheel traffic is enormous there have been excellent opportunities for testing the durability of various grades of steel rails, but the Boston Elevated Railroad has given opportunity for the most exacting tests, and some parts of the New York Subway are likely to prove very destructive to rails.

On the sharpest curve of the Boston Elevated the wear of the rails is so great that they have to be renewed every forty-four days, wearing down in this short period from 0.60 to 0.77 in. The inconvenience caused by such frequent renewals led to experiments with nickel steel. These rails only wore 0.53 of an inch in 204 days. A manganese steel rail now being tested is giving even better results, and will probably eventually replace the nickel steel rail. The rapid wear on sharp curves is apparently due to slipping of the wheels. The rigid axle prevents any differential action, such as is allowed for by the equalizing gear in automobiles, so that on curves either the inner wheel must slip backward or the outer one forward. Judging from the appearance of the rails, it is the outer wheel which does the more slipping.

Pick out some of the best of your circumstances, and consider how eagerly you would wish for them were they not in your possession.

More Wood Burners Retired.

The South Londonderry branch of the Central Vermont, one of the few narrow gauge lines in New England, has had the track changed to standard gauge. With this change the last of the old-fashioned wood burning locomotives in New England bade good-by to the public when they made their final trips on July 1, as coal burners only will be used on the new rails. The former were the only connecting link between the original and modern methods of railroading, and the travelers through Brattleboro and on the South Londonderry line, who looked with curiosity on the reminders of the former generation of transit by steam power, will surely miss the unique machines.

The Westinghouse Airbrake Company has received an order from the Missouri Pacific Railroad Company to equip 5,000 cars with air brakes. The shops of the company are rushed with orders for railroad safety appliances. Since the first of the year the company has received orders for the friction draft gear for these equipments of 150,000 cars from nearly all the larger railroads of the country.

The American Steel Foundries have received an order from the Great Northern Railroad Company for 1,000 truck bolsters to be applied to box cars which are to be built at the Pressed Steel Car Company's Works, McKees Rocks, Pa.

Big Turbine Steamers.

The Cunard Steamship Company are slow but sure, and the managers have determined to attempt regaining the former glory of having the fastest transatlantic vessels afloat. To bring about this result they are having two vessels built, one on the Clyde, and the other on the Tyne, that are expected to steam 25 knots, or 28.75 miles an hour.

The vessels will have four smoke stacks. As these ocean grayhounds are to serve as armed cruisers, each ship is to carry on the main deck several 4.7 guns. They will be 800 feet in length, and will have a gross tonnage of about 30,000 tons. The turbine engines are to drive four propellers, each fitted with a screw; they will thus be the first vessels to be propelled by quadruple screws. The total indicated horse power of the engines will be 70,000. The engine and boiler spaces are to be protected (in accordance with Admiralty requirements) by six-foot bunkers on either side, and these sections will, when emptied of their coal, be filled with sea water and serve in much the same way as armor plating. The steamers are also to be fitted with long distance wireless telegraphy appliances.

Envy of Wealth.

In an address made to the National Educational Association, President Roosevelt, among other sensible things, said:

"Venomous envy of wealth is simply another form of the spirit which in one of its manifestations takes the shape of cringing servility toward wealth, and in another the shape of brutal arrogance on the part of certain men of wealth. Each one of these states of mind, whether it be hatred, servility or arrogance, is in reality closely akin to the other two; for each of them springs from a fantastically twisted and exaggerated idea of the importance of wealth as compared to other things. The clamor of the demagogue against wealth, the snobbery of the social columns of the newspapers which deal with the doings of the wealthy, and the misconduct of those men of wealth who act with brutal disregard of the rights of others, seem superficially to have no fundamental relation; yet in reality they spring from shortcomings which are fundamentally the same; and one of these shortcomings is the failure to have proper ideals."

There is but one man in the world with whom you are to have perpetual contention and be always striving to exceed him, and that is yourself.

A Pipe Bridge.

The following illustration shows an interesting piece of work recently completed by Edward Kendall & Son, Cambridge, Mass. This pipe arch, which also serves the purpose of a bridge, is the property of the Massachusetts Metropolitan Water Works, and spans the Sudbury river at Cambridge. It is 80 ft. long, 7 ft. 6 ins. in diameter, is made of plate 5/8 in. thick and has a rise of 5 ft. 6 ins. above horizontal.

On account of the tremendous pressure it was necessary to back the abutments shown with 4 ft. of concrete, in which heavy angle iron rings are riveted on the pipe. Each one of the sections shown weighs about eight tons, and in order to protect them from moisture were dipped in an asphalt bath, for which a spiral tank, 9 ft. in diameter and 45 ft. high, containing a hollow core 6 ft. in diameter, was constructed. A traveling crane was used to drop the sections into this tank, which contained asphaltum heated by means of petroleum gas to 500 degrees Fahrenheit. Twenty minutes was necessary to coat the pipe, after which it was taken out and allowed to cool and harden. So well was this pipe constructed that no leaks of any consequence were noticed, when it was filled and light calking only was necessary.

A PIPE BRIDGE.

We are indebted to Joseph J. Ryerson & Son, Chicago, for the cut and description.

New Jersey Had the First Railroad Charter in the World.

One of the first railroads built in the United States was in the State of New Jersey, yet the people very rarely boast of the work their sires performed to start the wheels of progress. What they accomplished was important, but an earlier attempt in the same State to inaugurate the work of railroad building deserves much more attention than it has received. When William Hedley, the first man to build a practical locomotive, was wrestling to make his "Puffing Billy" haul coal cars more cheaply than horses, and when George Stephenson was trying to make his first engine turn the wheels in the direction wanted, the people of New Jersey passed an act providing for the first railroad ever chartered to do a general transportation business. The story as told in Francis Bagley Lee's History of New Jersey is as follows:

"The Legislature of New Jersey, upon the 6th day of February, 1815, passed an act creating a company 'to erect a railroad from the river Delaware, near Trenton, to the river Raritan, at or near New Brunswick,' and gave to the world what was probably the first railroad charter ever granted within the limits of the United States.

The personal influence that lay behind the measure was that of John Stevens, whose experiments with steam navigation on the Hudson gave him not only technical skill, but a wide and comprehensive grasp of the possibilities of any form of rapid transit.

The charter itself, as the basis of subsequent railroad legislation of a special character, possesses a permanent interest. In form the charter is evolutionary, bearing many of the characteristics of contemporaneous acts, similar in form, and from which turnpike companies derived their powers. Thus at the very outset a commission was created, authorized to receive subscriptions. For the construction of the railroad, 'not more than four rods wide,' the three commissioners, James Ewing, Pearson Hunt and Abner Reeder, were required to give security to the governor to insure to the treasurer of the company the payment of all subscriptions received by them.

The subscriptions were limited to five thousand shares at one hundred dollars per share, five dollars to be paid in at time of subscribing. As soon as two thousand shares were subscribed the commissioners, or a majority of them, were directed to call a meeting of the subscribers to choose a president and eight directors, 'five of whom shall constitute a board and a treasurer.' This temporary organization was to give place on the first Wednesday in November then next ensuing to a stockholders' election, which should afterward be held each and every year. 'The said president and directors so to be chosen shall be called the New Jersey Railroad Company,' says the act, with all corporate powers to be in full force and effect for fifty years.

In case the corporation did not carry into effect the objects of its charter within ten years, or allowed its works to go to decay for two years, then the charter became null and void.

All elections were required to be by ballot, in person or by proxy, at the rate of one vote for every share not exceeding twenty, and one vote for every five shares between twenty and fifty, and one vote for every ten shares above fifty. Temporary vacancies in the board of directors were to be filled by the remainder of the board. The president and directors were empowered to fix the time and place of meeting, appoint necessary agents and servants, make by-laws and ordinances and fill vacancies of an official nature.

To lay out the road the Legislature fell back upon the expedient of a further commission consisting of John Rutherford, Mahlon Dickerson and Richard Allison, who in the discharge of their duty were to have 'due regard to the situation and nature of the ground and the buildings thereon, the public convenience and the interest of the stockholders and so as to do the least damage to private property.' The road could not be laid out through any burying ground, place of public worship, dwelling house nor outbuilding of the value of three hundred dollars without the owner's consent. The commissioners were required to file their report, survey map and plot in the office of the Secretary of State of New Jersey. The commissioners and corporation were granted the right to enter upon land necessary for laying out the road and also for the purpose of searching for 'stone, sand or gravel for the use of the said road,' but no stone, sand or gravel was to be taken away without compensation made to the owner.

As to the character of motive power to be used upon the railroad the statute is silent, the only allusion being collateral, where it is enacted that the wagons or carriages employed on the road shall be constructed and run thereon in conformity to such rules as the company shall make from time to time. That animals, either horses or mules, were to be employed is suggested by the provision of the act empowering the corporation to 'make, erect and establish a railroad, passing and repassing, and which road is to be composed of either iron or wood for the running of the wheels, and which running part is to be fixed on a solid foundation, impervious to frost, not liable easily to be removed.' It was further provided that the middle path of said road was to be composed of some hard substance, of either stone, gravel or wood, so as to be good at all seasons of the year. The plan of a 'middle path,' and the further proviso that in no part of its progress should the road rise above an angle of two degrees above the plane of the horizon, would not directly indicate the employment of steam as an agency of transportation.

Further in the matter of construction the act provided that the company should not obstruct the free use and passage of any public road. Causeways were directed to be constructed by the railroad over all public roads, under a penalty of ten dollars for every day of neglect. The company was also required to furnish private causeways for the use of owners of land. Any injury to company property rendered the tortfeasor liable to forfeit to the company three times the actual damage sustained.

In the exercise of the right of domain the company was authorized to 'erect, make and establish all works, edifices and devices' as might be necessary, as well as purchase lands and tenements. In case of non-agreement between the corporation and an owner as to the valuation of private land necessary for the corporation's purposes, the statute provided that each should choose a disinterested freeholder. The two were empowered to determine compensation, but in case they failed they could choose an umpire. In case this method was not employed, a struck jury, after survey and estimation, made inquisition and returned the same to a justice of the Supreme Court.

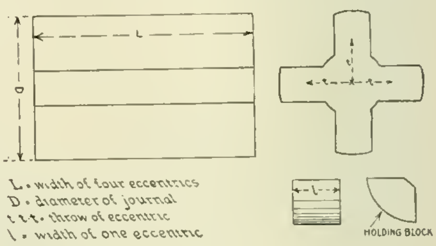
In the statute is to be found the germ of the present State railroad commissions. It was enacted that whenever the railroad company completed not less than ten miles of its road the governor of the State should appoint three disinterested persons who 'shall have power to fix, ascertain and determine the rates and charges which the said company may demand and receive for the transportation of merchandise and for every article of country produce, lumber and fire wood transported on the said railroad, and also to fix, ascertain and determine on such tolls and rates as the said company shall and may demand and receive from all persons using or traveling said road.' The rates of toll were directed to be placed on file as evidence in any court. If within ten years after the completion of the railroad the corporation should consider a revision necessary the governor was directed to appoint a new commission for that purpose.

Ten years after the completion of the road, and at the end of every ten years thereafter, the company was directed to lay before the Legislature a statement as to its financial condition. At such time the governor was to appoint a new commission of three to revise the freight and passenger rates, but it was provided that the commissioners should not reduce the tolls to a less sum than would insure to the company twelve per cent. per annum on its capital stock.

This first effort to construct a railroad across the State of New Jersey reached no further development than the passage of the act. The time was not yet ripe for so chimerical a project; more than another decade must elapse ere the public mind was ready to fully appreciate the benefits that lay within so great a plan of improvement. But the charter remains as the crystallization of the best thought upon the subject of what was proper legislative control over a railroad, what rights the corporation should have, and, in brief, what constituted so novel a scheme for transporting men and their goods between two centers of population."

Mandrel for Holding Eccentrics.

The mandrel and holding blocks shown in our illustration are of cast iron. Two holding blocks are required for each eccentric, thus providing a resting place for each set screw. The holding blocks fit closely between any two arms of the mandrel. Very little more time is required for getting eccentrics fastened onto the mandrel and into machine than



MANDREL FOR TURNING ECCENTRICS.

in handling one as is the custom in many shops. A set of eccentrics can thus be handled at once and a very material decrease in time can be secured by machining four eccentrics at one setting. We are indebted to Mr. E. O. Palmer for the sketch and the explanation. This method of turning eccentrics is in vogue in the Bloomington, Ill., shops of the Chicago & Alton Railroad.

In following out its policy of concentrating all shop work the Lackawanna Railroad has ordered the removal to Scranton of the construction shops at West Utica. The machinery will be taken to Scranton immediately and about September 1, when the new roundhouse is completed, the buildings will be torn down. About 100 workmen are affected by the closing of the shops, and while some of them will be given employment by the company elsewhere, many will be thrown upon their resources.

A new inspecting engine has just reached New York from the American Locomotive Works, and will be used by Vice-President Brown, of the New York Central, on his inspection tours. The engine is equipped with eight wheels, 62 in. drivers and 15x24 in. cylinders. The observation cab is finished in mahogany with leather upholstered seats.

Of Personal Interest.

Mr. R. K. Rochester has been appointed principal assistant engineer of the Vandalia.

Mr. D. C. Noonan has been appointed superintendent of the Minneapolis & St. Louis.

Mr. William Coughlin has been appointed general manager of the Kansas City Southern.

Mr. Dennis Sullivan has been appointed superintendent of the El Paso-Northeastern.

Mr. W. L. Cromlish has been appointed coal and coke agent of the Baltimore & Ohio, at Pittsburgh, Pa.

Mr. J. H. Travis has been appointed superintendent of bridges and docks of the Panama Railroad and Canal.

Mr. H. R. Duval has been appointed vice-president of the Kansas City Southern, with office at New York.

Mr. Oliver Rowe has been appointed superintendent of the Houston & Texas Central, with office at Ennis, Tex.

Mr. W. C. Edes has been appointed district engineer of maintenance of way, with office at San Francisco, Cal.

Mr. Thomas Tracy has been appointed assistant master car builder of the Erie, with office at Meadville, Pa.

Mr. F. L. Carson has been appointed master mechanic of the El Paso & Northeastern, at Almagordo, N. M.

Mr. W. K. Etter has been appointed trainmaster of the Atchison, Topeka & Santa Fe, with office at Topeka, Kan.

Mr. W. J. Donovan has resigned as assistant superintendent of the Second division of the Denver & Rio Grande.

Mr. Webb C. Ball has been appointed general time inspector of the Union Pacific, with headquarters at Omaha, Neb.

Mr. W. A. D. Short has been appointed signal engineer of the Queen & Crescent Route, with office at Chicago, Ill.

Mr. Addison B. Smith has been elected third vice-president of the Louisville & Nashville, at Louisville, Ky.

Mr. R. D. Hawkins has been appointed general master mechanic of the Great Northern, with office at Minot, N. D.

Mr. D. G. Sloan has been appointed assistant superintendent of the Rio Grande Western, at Salt Lake City, Utah.

Mr. A. R. Randolph has been appointed superintendent of the Pacific & Idaho Northern, with office at Weiser, Idaho.

Mr. D. G. Gray has been appointed division freight agent of the Baltimore & Ohio, with headquarters at Pittsburgh, Pa.

Mr. H. A. Worcester has been appointed assistant general superintendent of the Michigan Central. He was born at Albany, N. Y., on November 16, 1862, and is a graduate of Yale University. He began railroad life in 1885 as clerk in the stationmaster's office at the Grand Central Station in this city, and remained here five years, resigning at the end of that time. He was then appointed clerk in the superintendent's office of the Lake Shore. He besame assistant trainmaster on the Jamestown and Franklin division in 1892, and in the following year was made superintendent of the Lansing division. He went to Detroit in 1896, and afterwards to Buffalo. In June of this year he was transferred to Chicago, being appointed superintendent of the Western division, and this position he left to become assistant general superintendent of the Michigan Central. Mr. Worcester's headquarters will be at Detroit, Mich.

H. A. WORCESTER.

Mr. A. R. Oster has been appointed general superintendent of the El Paso-Northeastern, with office at Alamogordo, N. M.

Mr. Geo. S. Stewart has been appointed division superintendent of the Great Northern, with headquarters at Larimore, N. D.

Mr. C. A. Snyder has been appointed master mechanic of the Gulf, Colorado & Santa Fe, with headquarters at Cleburne, Tex.

Mr. J. F. Robinson has been appointed master mechanic of the Seaboard Air Line, in charge of shops at Savannah and Americus.

Mr. A. J. Anderson has been appointed division freight agent of the Baltimore & Ohio, with headquarters at Columbus, Ohio.

Mr. Jacob Kastlin has been appointed master mechanic of the Chicago, Burlington & Quincy, with headquarters at St. Joseph, Mo.

Mr. George H. Pegram has been appointed chief engineer of the Interborough Rapid Transit Co. and of the Rapid Transit Subway Construction Co. at New York.

Mr. Wm. Checkley Shaw has been appointed assistant to the president of the Georgia Southern & Florida, with office at Macon, Ga.

Mr. A. T. Hardin has been appointed assistant to the general manager of the New York Central & Hudson River, with office at New York.

Mr. M. C. Drinkel has been appointed superintendent of motive power and machinery of the Ixtlahuaca, Nani & Nijini Railroad, Mexico.

Mr. L. A. Gilbert has been appointed traveling engineer on the Maine Central Railroad. He will have jurisdiction over the line west of Waterville.

Mr. J. M. Rapelje, trainmaster of the Yellowstone division of the Northern Pacific, has been appointed superintendent of the same division.

Mr. G. W. Vaughan has been appointed engineer of maintenance of way of the New York Central & Hudson River, with office at New York.

Mr. R. H. Ingram has been appointed general superintendent of the new Southern District of the Southern Pacific, at Los Angeles, Cal.

Mr. George Kohler has been appointed road foreman of engines of the Chicago, Burlington & Quincy, with headquarters at St. Joseph, Mo.

Mr. J. W. Daniels has been appointed superintendent of the Missouri division of the Missouri Pacific and the St. Louis, Iron Mountain & Southern.

Mr. Frank Kingsley, formerly of the Chicago Great Western, has been appointed general foreman at Helena, Mont., on the Northern Pacific.

Mr. Homer Loring has been elected president of the Newton & Northwestern, at Geneva, Ill. Mr. Loring was formerly treasurer of the same road.

Mr. C. H. Seabrook has been appointed master mechanic of the St. Louis Southwestern, with office at Pine Bluff, Ark. Office of general foreman has been abolished.

Mr. D. W. Dinan has been advanced to be superintendent of the Pennsylvania division of the New York Central & Hudson River Railroad. Mr. Dinan was born in 1866, and at 17 began railroading as agent and telegraph operator at Binnewater, N. Y., on the Wallkill Valley. He was appointed train dispatcher on the West Shore at Kingston, N. Y., in 1886. In 1900 he was transferred as trainmaster to the Beech Creek district of the Pennsylvania division of the New York Central and in 1901 was made

D. W. DINAN.

chief train dispatcher on the division. In October, 1904, he was made assistant superintendent and held that position until advanced in May of this year to be superintendent of the Pennsylvania division.

Mr. F. M. Vanhoozer has been promoted to the position of traveling engineer of the St. Louis, Iron Mountain & Southern. He will have jurisdiction on the Valley Division.

Mr. T. E. Jarrett has been appointed superintendent of the Southern division of the Kansas City Southern, with office at Texarkana, Tex.

Mr. Samuel Moody, general passenger agent of the Pennsylvania Lines West of Pittsburgh, has been appointed general passenger agent of the Cleveland, Akron & Columbus Ry.

Mr. Andrew Gibson, superintendent of the Yellowstone division of the Northern Pacific, has been appointed superintendent of the Rocky Mountain division of the same road.

Mr. H. B. Palmer, superintendent of the Rocky Mountain division of the Northern Pacific, has been appointed assistant general superintendent of the same road.

Mr. M. J. Buckley has been appointed general superintendent of the Oregon Railroad & Navigation Co. and the Southern Pacific lines in Oregon, with headquarters at Portland, Ore.

Mr. H. M. Matthews, formerly division freight and coal and coke agent of the Baltimore & Ohio, at Pittsburgh, Pa., has been appointed general coal and coke agent of the same road, with office at Baltimore, Md.

Mr. John F. Wallace has resigned his position as chief engineer of the Isthmian Canal and as a member of the Isthmian Canal Commission. It is stated that he may accept an important position in New York.

Mr. George W. Mudd has resigned as master mechanic on the Wabash, and Mr. J. H. Dacey, formerly division master mechanic on the Chicago, Burlington & Quincy, has been appointed master mechanic at Moberly, Mo., to succeed Mr. Mudd, resigned.

Mr. J. D. Collins, formerly traveling engineer on the Atlantic Division of Southern Railroad, has been appointed one of the air brake instructors on the same road.

Mr. S. Ferguson, an engineer on the Southern Railroad, has been appointed one of the air brake instructors on the Southern Railroad. His headquarters will be in the instruction car.

Mr. F. N. Norman, formerly of the Seth Watkins Machine Co., Hattiesburg, Miss., has been appointed engine house foreman of the Illinois Central at Harrihan, La.

Mr. John G. Miller, road foreman of engines for the entire line of the Buffalo, Rochester & Pittsburgh, has been transferred to road foreman of engines of the Buffalo and Rochester divisions, with headquarters at East Salamanca, N. Y.

Mr. Albert Jones, formerly night dispatcher on the New York Central at De Witt, N. Y., has been appointed general foreman of engines at Rochester, N. Y., on the same road. Mr. Jones was presented with a diamond by his many friends before leaving De Witt.

Thomas Lawson notifies us that he has severed all connection with the Lawson Dump Car Company, of 22 Park Row, New York, and that he is now the president and general manager of the King-Lawson Company, of 32 Broadway, New York. Mr. Lawson is the inventor of a car that will dump instantaneously on either side and absolutely clear of the rail anything put into it. He will be pleased to send an elaborate catalogue containing a full description to anyone interested.

Mr. Geo. T. Ross has been appointed general superintendent of the Iowa district of the Chicago, Burlington & Quincy. He was born at Truro, N. S., in 1866. He was in train service from 1884 to 1887 on the Intercolonial. In the latter part of 1887 he went to the Minnesota & Northwestern. He served on the latter road and other roads until 1898, when he was appointed trainmaster on the Eastern Railway of Minnesota, and in a short time was made assistant superintendent of that road, and then appointed assistant general superintendent of the Montana Central. He was pro-

GEORGE T. ROSS.

moted to be general superintendent of the latter road on July 1, 1901. He went to the Missouri Pacific, as superintendent, from whence he went to the C., B. & Q., on the staff of the second vice-president. In 1904 he was appointed general inspector of station service of the same road, and this position he left to become general superintendent.

Mr. James Spellen, a locomotive engineer on the Middle Division of the Buffalo, Rochester & Pittsburgh Railroad, has been appointed to the position of road foreman of engines, with jurisdiction over the Middle and Pittsburgh Divisions, with headquarters at Du Bois, Pa. He was promoted from firing to running a locomotive on this road in October, 1886. An occasional article by Mr. Spellen has appeared from time to time in the columns of the Railway and Locomotive Engineering, which has been of interest to his fellow engineers.

Mr. Harold U. Wallace has accepted the third vice-presidency of J. G. White & Co., Inc., of New York. Mr. H. U. Wallace resigned as chief engineer of the Illinois Central Railroad to accept this position. He has been connected with that road since 1894, and since 1902 has been its chief engineer. Among other important work carried out for the Illinois Central by Mr. Wallace was the lake front improvement work at Chicago. This work included the depression and reconstruction of twenty miles of main lines and yard tracks.

Mr. Clarence Morgan, formerly treasurer of the Rutland Railroad, has been appointed head of the new department of railroad transportation at McGill University, at Montreal, Canada. Mr. Morgan is a graduate of Harvard, and entered the service of the New York Central about ten years ago. He was connected with the accounting department. He had previously had experience in the general management and working of the construction and operating departments of railroads. He was also connected for a time with the Norfolk & Southern, and in this way he gained a wide knowledge both in the theory and practice of modern railroading.

The handsome diamond ring, presented to Chairman Chas. W. Martin, Jr., by the Supply Men at the Master Car Builders' ball, Oriental Hotel, Manhattan Beach, was purchased from the well-known firm of William R. Phelps & Co., 3 Maiden Lane, New York. Those contemplating gifts would do well to write this firm; they are anxious that the "railway people" should learn to know them.

Our associate editor, Mr. George S. Hodgins, is ill, and has gone to recuperate among the Canadian lakes for the summer. We all cordially wish that Mr. Hodgins may have a speedy recovery. Mr. James Kennedy, a man of mature mechanical experience and a writer of admitted ability, is filling the chair left vacant by the absence of Mr. Hodgins. Our chief, Mr. Angus Sinclair, has gone to Europe for a much needed rest. He carries a trunk well loaded with notes on things which are proper subjects for investigation.

Mr. John F. Stevens has been appointed chief engineer of the Isthmian Canal Commission, with headquarters on the Isthmus of Panama. Mr. Stevens' salary will be $30,000 a year. He was born at West Gardiner, Me., April 25, 1853. In 1875 he was assistant engineer of the City of Minneapolis. This position he held about a year, when he took up railroad work, and was for three years assistant engineer on the Sabine Pass & Northwestern, the Denver & Rio Grande, the Chicago, Milwaukee & St. Paul, the Canadian Pacific, the Duluth, South Shore & Atlantic, and the Spokane Falls & Northern. In 1890 he was made principal assistant engineer of the Great Northern, and was promoted to be chief engineer of that road in 1895, holding that position until 1898, and for about a year was engaged in railway contracting. In the latter part of 1899 he returned to the Great Northern as chief engineer, and in 1902 was appointed general manager of that road. In 1903 he resigned as general manager and chief engineer to accept the position of chief engineer of the C., R. I. & P., and within a short time was appointed fourth vice-president, and in April, 1904, was elected second vice-president of the same road. He resigned the latter position in May of the present year, being selected by the Government to be Government railway expert in the Philippines. He was about to accompany Secretary Taft to Manila when he accepted his present position of chief engineer with the Isthmian Canal.

The Buda Foundry and Manufacturing Company of Chicago have recently increased their sales force by the addition of Mr. J. E. Sanderson. This gentleman was formerly with the Rock Island road. This company have added to their staff of traveling representatives Mr. Jas. H. Bannerman, who was formerly mechanical superintendent of the Tennessee Central. Mr. Bannerman will represent chiefly the metal department of the Buda Company and will demonstrate to the mechanical departments of various railroads the advantages claimed for some of their new compositions which have recently been placed on the market.

Motor Cars on Missouri Pacific.

J. H. Richards, attorney for the Missouri Pacific Railway, in Kansas, has informed the State Board of Railroad Commissioners and the Topeka Commercial Club that motor cars will be in operation on two of the Kansas branches of that road before the end of the year. The management of the Missouri Pacific has decided to discontinue its passenger service on the Topeka-Ft. Scott and Larned-Winfield branches. This decision brought a protest to the railroad commissioners from residents of the affected districts, and Mr. Richards went to Topeka to make his announcement to the board.

"The management of the company," said Mr. Richards, "has informed me that motor cars will be in operation on these branches by early fall. The company has been working for some time on a motor car which is expected to be greatly superior to anything now in use."

The Curtis Steam Turbine.

Important tests of the improved Curtis Steam Turbine have been made last month by the General Electric Company at Schenectady, N. Y. The tests were made by Mr. Frederick Sargent and Mr. Louis A. Ferguson, and the results are particularly interesting as showing several marked improvements in results. The machine as tested, a 2,000 K.W. steam turbine generating unit, conforms as nearly as possible to the standard four-stage machines now being produced and operates at 900 R.P.M. The tests were reliable and accurate and the results obtained were as follows:

FULL LOAD TEST.

Duration of test..........	1.25 hour
Steam pressure (gauge)...	166.3 lbs.
Back pressure (absolute)..	1.49 in. of mercury
Superheat	207. deg. F.
Load in Kilo-Watts.......	2023.7
Steam consumption per K.-W. hour...............	15.02 lbs.

HALF LOAD TEST.

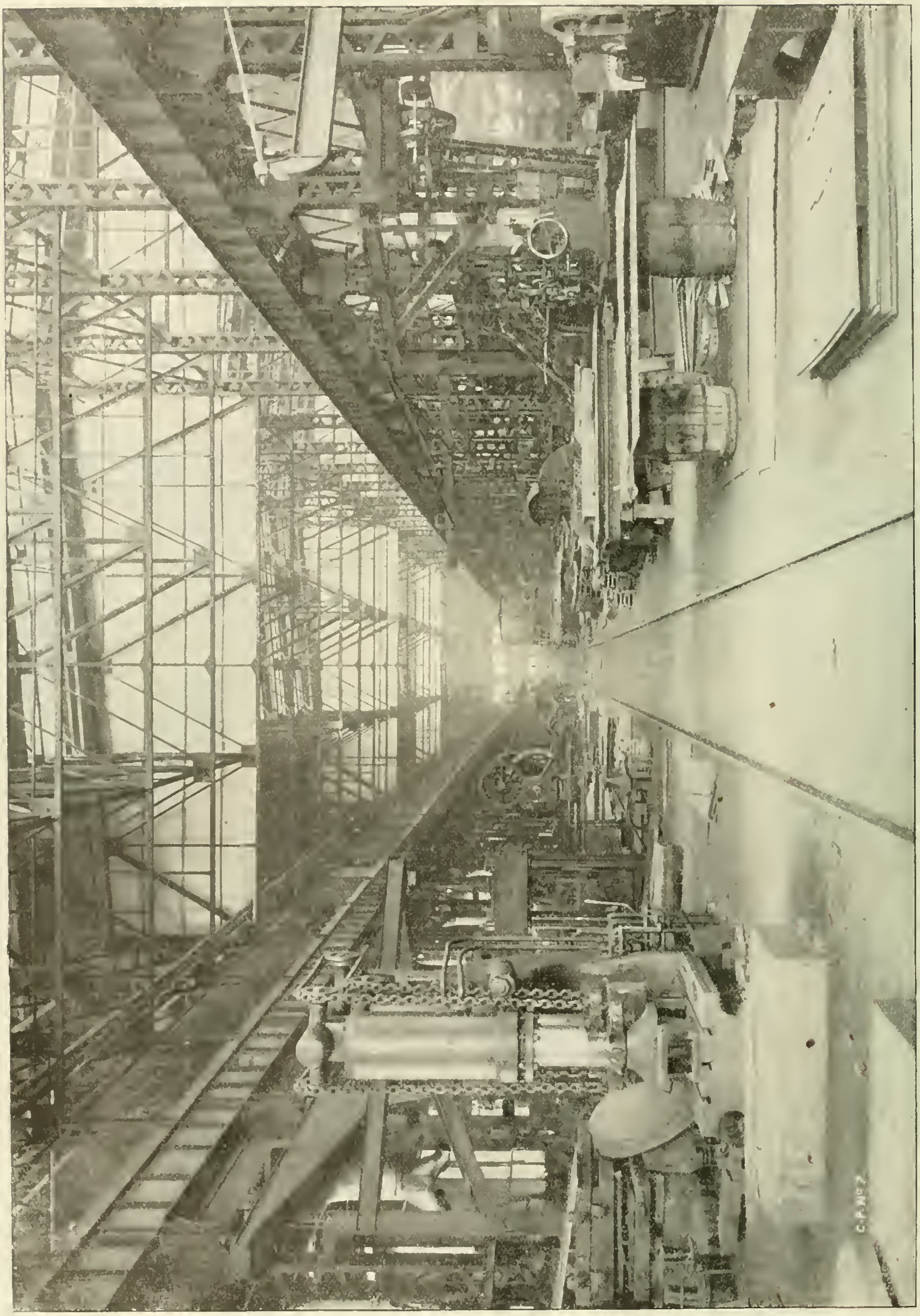
Duration of test..........	0.916 hour
Steam Pressure (gauge)..	170.2 lbs.
Back pressure (absolute)..	1.40 in. of mercury
Superheat	120. degrees F.
Load in Kilo-Watts.......	1066.7
Steam consumption per K.-W. hour...............	16.31 lbs.

The largest order for safety valves ever placed at one time by a railroad company has just been given to the Hayden Company, of Columbus, Ohio, by the Baltimore & Ohio Railroad. The order embraces 488 4-in. all brass pop safety valves. They will be used in the equipment of the 244 locomotives being built by the American Locomotive Company for the B. & O. Company.

The B. F. Sturtevant Co., of Boston, Mass., has recently sold for export to Japan, a complete lumber dry kiln equipment, consisting of a steel plate engine driven fan with direct connected heater, and a full outfit of iron work for lumber trucks, tee rails, etc.

Master Mechanic Daniel Deeter has turned out a new locomotive from the repair shops of the Reading Railway at Reading, Pa., which is attracting much attention. The driving wheels are 7 ft. high. The engine weighs 65 tons. The finishing is a sample of fine workmanship. The cylinder heads are nickel plated, the frames shine like silver, and the mountings look like burnished gold.

Superintendent McCarty, of the Southwest System of the Pennsylvania Railroad, is greatly interested in an automatic stoker invented by two employees of the Haven Company. The coal is carried from a tender to a hopper from which, by the use of steam, it is scattered into the fire. There is much secrecy about the tests.



MACHINE BAY OF LOCOMOTIVE SHOP, ANGUS SHOPS OF THE CANADIAN PACIFIC RAILWAY.

New Shops on the Canadian Pacific Railway.

Many of the railway companies in the United States would do well to take a lesson from the Canadian Pacific Railway, who has recently opened their new shops at Montreal. The tool equipment of these shops is in many respects the best in the world. The Niles-Bement-Pond Company secured the order for practically all the large machines.

As will be seen from the illustration on the next page, the shops are of vast proportions, the main shop, of which the illustration is a view, covering about 4½ acres, the length being 1,167 ft. by 162 ft. 8 ins. in width. The shops were planned for repairing 50 locomotives per month, and for building 6 new locomotives per month. This record will likely be surpassed, as some of the records already made are of a surprising kind, as, for instance, on the Niles driving wheel lathe, 6 pairs of 57-in. driving wheel tires were turned out in 10 hours and 15 minutes, 3 of the pairs being flange tires and 3 pairs blind tires. On another occasion 2 pairs of 84-in. tires were turned in a little over 4 hours. In driving boxes, wedges and similar work, the slab milling machines are doing about six times as much work as the old planers could accomplish.

It is also gratifying to learn that a thorough system of training and examining apprentices has been established, and with its new appliances and new methods of training skilled mechanics, the Canadian Pacific bids fair to lead in the matter of repairs of equipment for many years to come.

Chicago, Rock Island & Pacific Freight Engine.

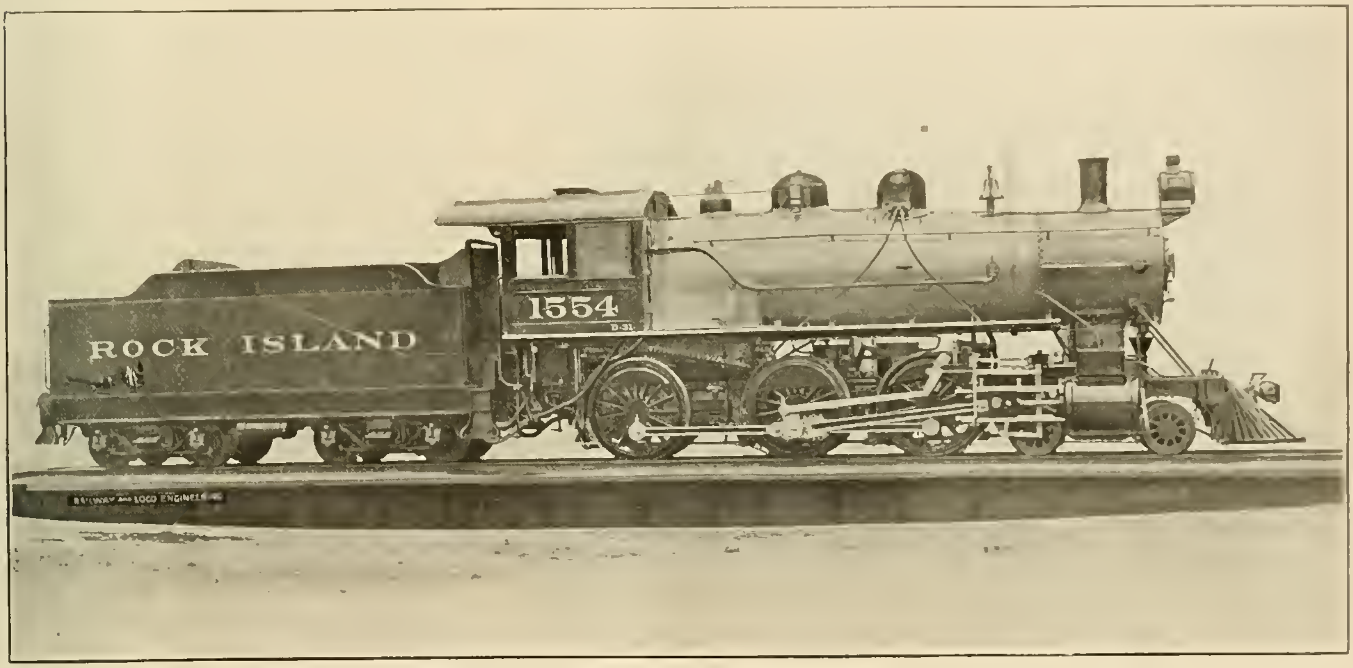
The accompanying illustration shows a new freight engine just finished at the Baldwin Locomotive Works for freight service on the Chicago, Rock Island & Pacific Railroad. The engine, which is of the 4—6 wheel type, is finished with Walschaert valve gear, and is an innovation in this class of engine. The valve gearing, as will be seen from the illustration, is attached by a connecting rod to a crank on the outside of the main driving wheel, and is a novel and ingenious contrivance which, its friends claim, will supersede the more intricate eccentric and link motion.

The other parts of the engine comprise all of the best known qualities of high class freight engines. The slide valves are of the balanced type. The boiler is of steel, and constructed on the wagon top variety, with a diameter at the front end of 68 ins. The thicknesses of the sheets are 11/16 in. and ¾ in., and the working pressure is set for 200 lbs. The fire box is also of steel with a length of 96 ins. and a width of 67 ins., depth at the back of the fire box being 58 ins., with a slope of 14 in., or 72 ins. in front.

The tubes are of the best charcoal iron, No. 11 gauge, of which there are 329, with a diameter of 2 ins. and a length of 14 ft. 2 ins. This gives a total heating surface of 2,586 square feet.

The driving wheels have a diameter of 63 ins., the axle journals measuring 10 ins. by 12 ins. The engine truck wheels are 30½ ins. diameter, giving a wheel base of 26 ft. 6 ins. The total length of engine and tender is 56 ft. 5½ ins. The weight on the driving wheels is 131,200 lbs., and on the truck 42,520 lbs., making a total of nearly 175,000 lbs.

The total weight of the engine and tender is 304,000 lbs. The working of the engine will be watched with much interest, as the test of the merits of the valve gear is having a fair chance on a splendid type of engine. The tractive force of the engine in ordinary service is 33,900 lbs.



CHICAGO, ROCK ISLAND & PACIFIC FREIGHT ENGINE.
T. S. Lloyd, General Superintendent Motive Power. Baldwin Locomotive Works, Builders.

Improving the Baltimore & Ohio Railroad.

An important improvement on the main line of the Baltimore & Ohio Railroad, west of Ellicott City, Md., has been begun whereby the road will be greatly improved in that mountainous region now so full of curves and steep grades. The work will include two tunnels, one nearly four hundred yards, and the other nearly two hundred yards in length. When this is completed the present roadbed will be entirely abandoned. The distance will be shortened nearly two-thirds of a mile, the liability to damage by freshets will be avoided, and an easy and regular grade maintained.

Recent improvements on the roadbed foot up to nearly $8,000,000, the present proposed alteration will cost between six and seven hundred thousand dollars.

The best way to raise anyone is to join with him in an effort whereby both you and he are raised by helping each other.—*Theodore Roosevelt.*

Union Pacific Motor Car.

The car illustrated in the annexed engraving is for high speed interurban and branch service, to take the place of electric trolley cars. Gasoline motor supplants electric cars—one more step in the advance of interurban service.

The line of design of this car is unique and entirely new; is modeled after the lines of the racing yacht Reliance, inverted.

The rear of the car is rounded off, avoiding the vacuum produced by square-end cars. The front end is tapered off into a sharp point.

Roof is tapered down from the top, affording least resistance, and having a splitting effect upon the atmosphere.

The roof is perfectly smooth except for the Cottier ventilators. These ventilators exhaust, by suction, the air from inside of car.

The upper deck and the old style deck sash ventilators have been done away with.

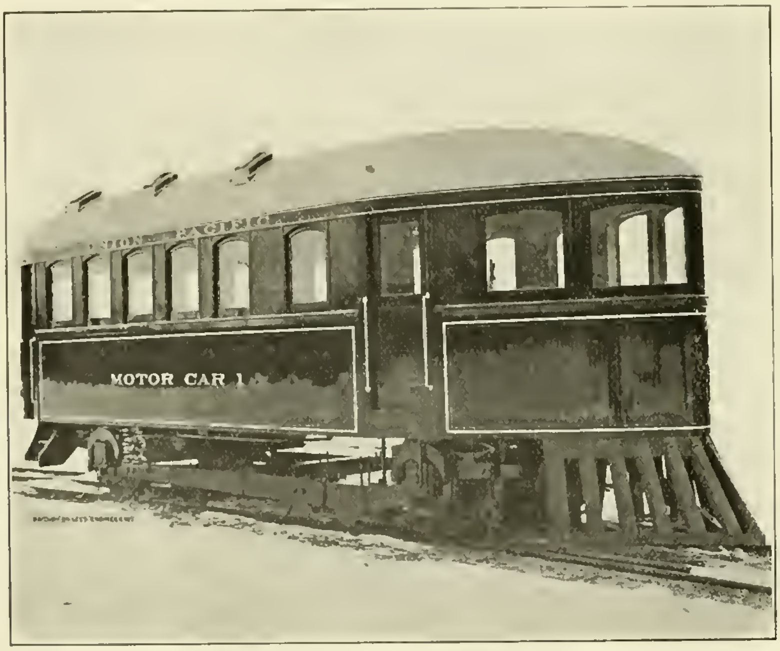
The truck carrying this car is of original and unique design, with many new features, and embodying the good points of the street car, Pullman palace car and locomotive truck. The particular feature is the design of springs for this car. They are so constructed and applied as to avoid entirely the teetering action ordinarily experienced with the old style trolley car. The car has 42-in. wheels. The motive power of this car is a six-cylindered gasoline engine, manufactured by the Standard Motor Works, Jersey City, N. J.

Large air reservoirs are carried underneath the car, and with the assistance of this air pressure and starting device the car is rapidly put in motion, and picked up by the gasoline engine to the maximum speed, without jar, in the minimum space of time.

This six-cylinder gasoline engine is a wonderful piece of machinery and is very similar to the engine used in the Standard auto boats, which made such a wonderful record in the auto boat races on the Hudson river last June. The Standard Boat No. 1 was capable of from 25 to 30 miles an hour.

The engine was re-designed and built in accordance with railroad company plans, making it applicable to motor car service. There is practically no limit to the speed that may be attained by this motor car, but it will probably be limited to about 40 miles per hour.

Car has an acetylene headlight; is also lighted by acetylene gas with opalescent panels, giving a strong, powerful light over the shoulder for reading purposes, but the general light of the car is pleasing and restful to the eye, which is a marked contrast to the ordinary system of illuminating cars, where the light in one part of the car is brilliant, while throwing shadows in another part of the car, which is very disagreeable, particularly to those unused to or affected by traveling.



GASOLINE MOTOR CAR ON THE UNION PACIFIC.

This particular car is intended for local passenger service out of Portland, Oregon. It is painted a beautiful maroon, with aluminum trimmings.

A car of the foregoing design is of immense strength; impossible to telescope or crush; therefore affording great safety to passengers in case of accident or wreck.

This car was designed and built at the Omaha shops of the Union Pacific Railroad Company, under the supervision of Mr. W. R. McKeen, Jr., Superintendent of Motive Power and Machinery.

The Organization of the Smithy.

The following are some extracts from a paper read by Mr. W. B. Reid, foreman blacksmith, before the shop foremen's meeting on the Delaware, Lackawanna & Western, held recently at Buffalo.

Among other things he said: To reduce cost and at the same time increase the efficiency of his department should be the aim, as it will ultimately be, the test of the successful foreman. This is equally true from the highest to the lowest in railroad service to-day and in every instance successful results depend very largely upon organized method and system, intelligently planned and persistently followed.

At the outset I would point to the importance of the order book system. A white book for general repairs, a blue book for running repairs, and a yellow book for general and miscellaneous.

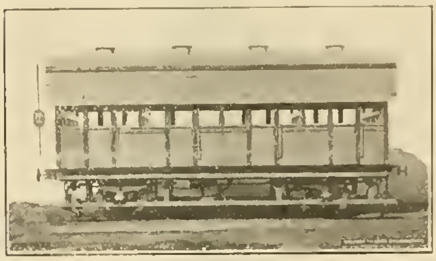
The absurdity of a foreman being obliged to accept a few score verbal orders daily from employes of every department, roundhouse, back shop, car shop, roadway sections, building and bridge department, coal trestles, ore works, etc., may very readily be understood.

Much of the opposition I met with came from foremen and other officials themselves, who seemed to consider the presentation of properly accredited orders for material and labor furnished by blacksmith shop, a presumptious piece of red tape, and an imposition upon the dignity of their position.

The order system should be honored by all foremen and other officials. First, because it is proper business form and its observance fosters stricter business habits all round. Second, because it compels carefulness and economy on the part of the workman to whom the order is issued, since he knows he cannot duplicate the material and labor without the knowledge of his foreman, explanations being necessary. Third, it forms a ready and valuable record of the operations of the blacksmith shop, and enables a more correct apportionment of the labor and material of that shop being made. Fourth, it is important that all orders should be issued by foremen personally, that their requirements as to material and measurements, forge or finish sizes, etc., be as plain and explicit as possible. Fifth, all requests from workmen for orders for tools and appliances from blacksmith shop should be reasonably investigated by foremen as to their necessity and utility. This point is worthy of larger consideration than might at first sight be imagined. While we are fully aware of the fact that a large amount of the work of the blacksmith shop must necessarily be in the line of tools and appliances for other departments, yet considerable economy might be effected by a closer scrutiny by the ordering foremen of their necessity and value.

During the past three years I have known of a large amount of expensive forgings that were never used, many that were never taken from the smith shop, that ultimately found repose in the scrap heap. Much of this waste may have been due to the frequent changes of foremen, whose ideas of what constitutes improvement necessarily differ. Still the fact emphasizes the necessity of reasonable care and consideration in this matter.

In issuing orders it would be of benefit all round if the chronic "rush" feature could as far as possible be omitted, since in the majority of cases it is only a covert confession of failure on the foreman's part to order promptly and in advance. At this point it may not be out of place to mention the fact that negligence of foremen to order systematically by monthly requisition often imposes upon the smith shop the necessity of supplying things at excessive cost, besides causing congestion and delay in the legitimate work of the smith.



GREAT INDIAN PENINSULAR COMPARTMENT CAR.

"Do unto the blacksmith foreman as ye would that he should do unto you." Undoubtedly a little more of the spirit of the golden rule all round would have a wonderful influence in unifying and harmonizing the relations and interests of the different departments now too often regarded as antagonistic. Less of this thoughtless, selfish, "up-to-you" sentiment and more of the healthful "community of interest" spirit would inject into the service a stimulus productive of highest efficiency.

Considerable economy in the work of the tool fire might be effected by a more systematic handling of machine and other tools.. 1st. By having boiler shop, machine shop and roundhouse, flat and cape chisels, handle chisels and punches, etc., collected in quantities in their respective departments and sent in suitable boxes to blacksmith shop for repairs. This would, in the absence of a check system, prevent the useless hoarding of these tools by individual workmen, and frequent personal visits to blacksmith shop with tools requiring repairs. 2d. By having a sufficient number of duplicate machine tools, the work of the tool smith could be rendered more methodical and loss of time by machinists waiting for tools to be repaired. 3d. By the adoption of some specific and uniform standard of shape and proportion of the various machine tools the work of the tool smith would be greatly facilitated. The constant embarrassment occasioned by the effort to conform to the varied ideas of numerous successive foremen is not conducive to economy of time and material. 4th. A stricter watch by machine shop foreman of the abuse of machine tools in grinding would lengthen considerably the service of the tools and relieve the pressure upon the tool fire.

The regular and systematic assembling in quantities of locomotive parts requiring case hardening would lessen materially the cost of this operation to the blacksmith department, since the same time, fuel and attention is necessary for a few as for a larger number of pieces, while more uniform and durable work would be obtained.

I need hardly emphasize the importance of this subject, yet it is surprising how few comparatively among even good mechanics understand the relative value of an article properly case hardened and one merely "potashed."

Case hardening is the process of imparting an exterior casing or coating of steel to iron forgings subject to great frictional wear, as in locomotive motion work, thus combining in the parts the internal pliancy of iron with the external wearing quality of steel. This is effected by packing the forgings in some substance rich in carbon (the constituent element of steel) such as bone dust, in an iron pot or box and keeping the same at a good red heat for from 10 to 20 or more hours, which will ensure a steel surface of from 1/16 to ⅛ inch, sufficiently deep for all practical purposes. Hardening with prussiate or potash, on the other hand, effects the surface of the forgings only to the infinitesimal part of an inch, and is comparatively worthless for practical purposes.

We have in our shop been following a system which, I think, will result in better conditions. That is to work up a liberal stock of all the various kinds of motion pins and parts, finishing them as nearly standard to sizes as possible, carbonizing them and returning them to machine shop where they can be fitted and hardened as required. We have now several hundred motion pins of all classes carbonized in this way, on stock ready to be applied in reliable condition on shortest notice. I would recommend continuing the same plan with knuckle joint pins, having always from 50 to 100 on hand in this carbonized condition. This would effectually prevent the possibility of excuse, under any pretext, of applying a pin merely potashed.

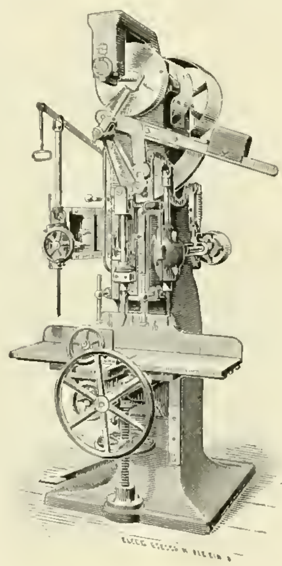
The prompt assembly and delivery in blacksmith shop of all work for repair from newly stripped engines is a point of economical value to blacksmith department, enabling the blacksmith foreman to adapt his resources most economically to meet the visible requirements, ensuring better work and prompt redelivery of material. It is also a mistake to hold back work under the idea that by rushing it at the close of the month it will be done quicker and cheaper and thus reduce the cost of engines. This kind of thing only occasions feverish rush, and confusion, fatal to good management; especially is this so when a large quantity of roundhouse and other emergency work accumulate at the same time. The delivery of work from the blacksmith shop is a matter likely to evoke a difference of opinion. The method at present followed is for the blacksmith foreman to notify the foreman of other departments of work ready for them. This has hitherto proved satisfactory.

The handling of the scrap would also be more cheaply done by having a car conveniently located at abandoned track to the west of blacksmith shop. This would also prove a great convenience to roundhouse. It certainly would be an object of economical importance to all foremen to keep the various classes of workmen more closely in their own departments. The numerous trips to the blacksmith shop under the pretext of looking after material, etc., is just so much loss of time to their respective departments and foreman. By following out the order system as briefly outlined all necessary business between the blacksmith shop and others could be carried on quite efficiently by laborers or boys designated for such purposes, and foremen would have little occasion or excuse for personal dealing with individual blacksmiths, but would respect their own and blacksmith foreman's position by doing all necessary business with him and through him.

The New Jersey Asbestos Co., of Camden, N. J., are meeting with marked success in their various departments, and are especially gratified with the immediate and popular reception accorded to their new high pressure packing which is gaining golden opinions everywhere. The increase of business in the South has been so marked that in order to accommodate their patrons there they have opened a branch office at 1718 First avenue, Birmingham, Ala. Mr. James O'Rourke, for many years connected with the Southern Railway will have charge of the office.

Large Car Mortising and Boring Machine.

A very heavy and substantial car mortiser and borer has been brought out by the J. A. Fay & Egan Company, of 445 W. Front street, Cincinnati, designed to cut in any kind of wood, mortises from ¼ in. to 3 ins. wide and up to 6 ins. deep, and adapted for the heaviest description of car and bridge work. The column is a single casting, which, being hollow, is amply strong to stand up to the heaviest strain to which a machine of this kind may be put. The entire machine is self-contained, and its broad floor base insures freedom from vibration. The driving pulley and crank shaft are supported between the bearings instead of being overhung, as is the case with some machines, adding materially to its capacity and power. The outside bearing supports the crank shaft in front.



No. 69—CAR MORTISER AND BORER.

The front and center bearings are placed on top, being a part of the main column, and receive the shock of the ram. This is one of the new features of this machine, and is claimed to be superior to all other methods for this purpose. The new strap device on the upper end of the pitman, connecting it with the crank shaft, is especially provided for the takeup of the wear and to permit changing the bronze bushing without dismantling the upper part of the machine, saving much time and labor over other methods.

The chisel mandrel, large in diameter, and made of the best cast steel, is connected to a solid ram working in planed ways, making it impossible for the mandrel to spring when mortising at full stroke the hardest kind of wood. It has a perfectly graduated stroke, commencing at a still point above the extreme upper throw and working gradually down into the mortise, with little or no perceptible jar and under perfect control of the operator. The chisel reverser, which is perfectly automatic, is controlled by a treadle movement operating upon the chisel mandrel and reversing the chisel every time it is brought to the still point by releasing the treadle, locking the chisel bar and holding it in the correct position. The radial slide is attached to the connections and operated by the treadle, and prevents the slightest jar on the foot, even when mortising without first boring a hole to admit the chisel, a feat which it is claimed has heretofore never been accomplished on a machine of this kind.

The bed will receive timber 19 ins. wide x 16 ins. thick, and the chisel will cut a mortise 6 ins. deep, or, by changing the face of the timber, it can be made to mortise clear through the thickness of 12 ins. The table is supported on a central screw, by which means the effect of the thrust or blow of the chisel is conveyed to the foundation and relieving the table bracket. The table is 48 ins. long and has a longitudinal movement by means of rack and pinion of 27 ins. There are two boring attachments, arranged in a novel and compact manner, one on a line with the chisel, to bore the hole to start the mortise, and which will bore to a depth of 8 ins.; also an adjustable auxiliary boring attachment, for boring bolt holes, which has a 15-in. stroke and may be moved by a hand wheel and screw to bore to any point within the width of the bed, which is 19 ins. Both boring attachments are driven directly from the countershaft of the machine, and each is provided with a stop for gauging the depth in boring. A spring counterbalance is provided for returning the boring mandrel after the stroke.

Terms can be had from the makers. Also ask for either their new illustrated catalogue of woodworking machinery or books on hand saws and sanders.

Crane Company's Fiftieth Anniversary.

The fiftieth anniversary of the Crane Company, of Chicago, was a social occasion of more than ordinary importance. The inspection of the factories by the branch managers on July 4, the entertainment of the employees by Mr. R. T. Crane at his palatial residence at Lake Geneva, Wis., on July 5, and a picnic at North Western Park, on July 6, attended by over 10,000 people, formed a unique and popular celebration rarely equaled in America.

This history of the Crane Co., from its inception to the present hour, reads more like a chapter in romantic realism than the natural growth of a commercial industry. A penniless foundry lad working in the sand in the back of his uncle's lumber yard, took off his "first heat" on July 4, 1855. His first castings were couplings and pipe fittings. To-day there are twenty-five branches of the industry located in the chief cities of America, employing thousands of skilled workmen. The merit of the work of the Crane Co. has met with universal approval. Awards have been made by the juries of many American exhibitions, and the company was awarded the only gold medal given at the Paris Exposition in 1900, for exhibits of valves and fittings.

It would be a long story to tell of the growth from the small back-yard foundry to the present chain of mammoth foundries and factories, but through it all can be seen the plodding industry, the tireless energy, the patience that never wearied, the honesty that was never challenged, the methods that commanded respect, until from the foundry that turned out the best steam fittings in the West came also steam warming appliances, elevators, air brakes, steam pumps and steam engines, and latterly electrical appliances, each and all unsurpassed in workmanship and quality, until at the present time the company manufactures about 10,000 articles for use in connection with steam, water, gas or air.

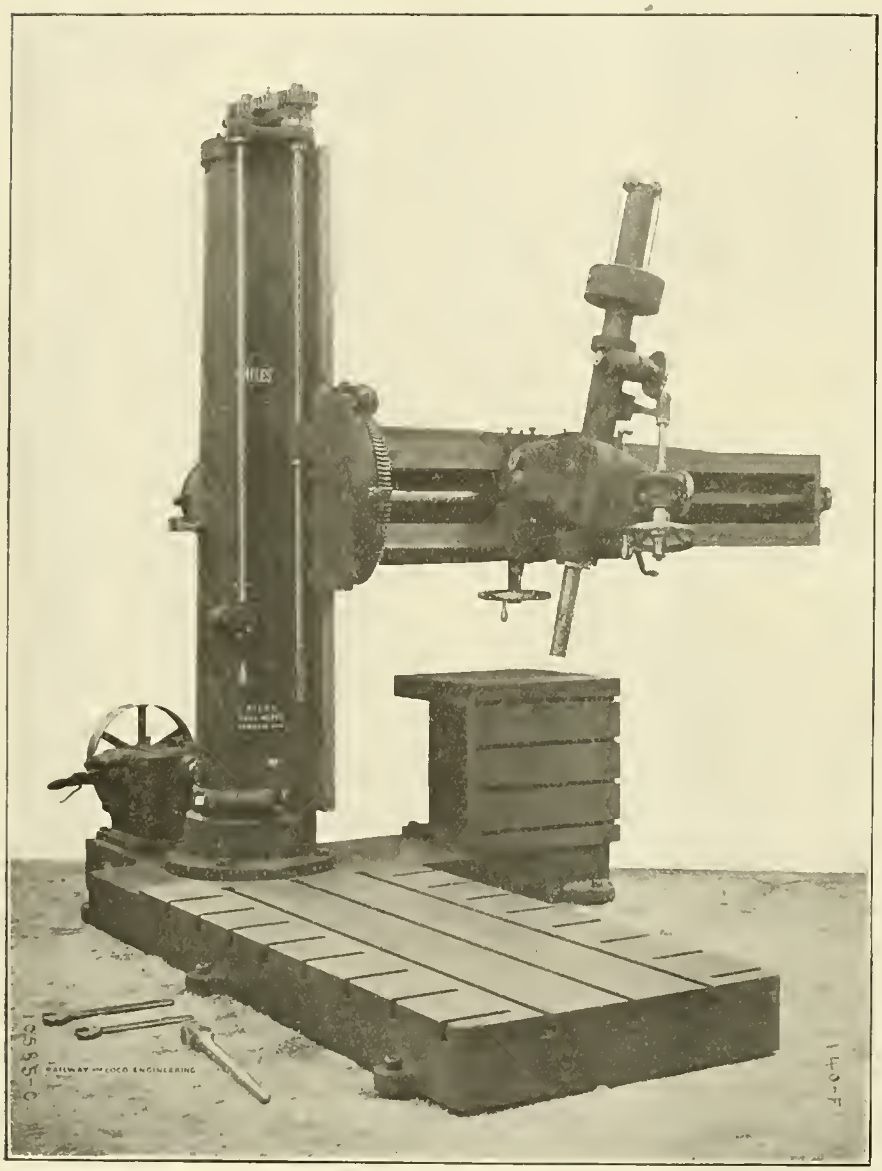
A feature of Mr. Crane's relations with his employees deserves more than passing comment. In addition to pensioning his older employees, he began in 1899 the system of awarding 5 per cent. to the employees at the end of the year as a bonus in addition to their wages. The last two years it was increased to 10 per cent. Mr. Crane has also established high class training schools and provided 24 scholarships of $500 each per year to enable young men to prepare themselves as teachers of manual training. The Chicago Board of Education has recently named a new school the R. T. Crane Manual Training School in his honor. Mr. Crane is worthy of the high honors and great good fortune that has come to him, and his methods of dealing with his employees are worthy of the imitation of all of our captains of industry.

The tendency of people engaged in the construction of railway appliances in New England to permit their plant to deteriorate is again illustrated in the sale of the Newburyport Car Works, which took place lately. The wooden buildings, 109x86 and 120x52, each two stories, with all the shafting, piping, belting and wiring for electricity, were sold to G. C. Elliott, Haverhill, for $4,797.

A life without a purpose is a languid drifting thing. Our improvement is in proportion to our purpose.—*Thomas à Kempis.*

New Six-Foot Niles Universal Radial Drilling Machine.

The accompanying illustration shows a drilling machine which is the result of a large experience by the makers in the design and manufacture of radial drills. It is built to use high-speed drills to their fullest capacity. The drill head saddle fits between as well as outside of the arm guides, which completes the double box section of the arm and insures great rigidity. The column saddle is strongly gibbed to flat scraped bearings on the column and the post above which the column revolves extends to the extreme top of the sleeve. The use of large shafts, steel gears, bronze bushings and ring oiling bronze bearings for all fast running shafts makes a strong, durable machine capable of standing the hardest service. The principal feature, however, of this machine is its convenience and ease of manipulation. All the feeds and speeds are changed by means of lever, and great care has been taken to arrange the levers and hand wheels, so that they shall be within easy reach of the operator. The column rests on ball bearings. An idea of the simple compact design of the machine can be gained from the photograph.



NEW SIX-FOOT NILES UNIVERSAL RADIAL DRILLING MACHINE.

The machine is adapted for use with either carbon or high-speed drills, the range of spindle speeds being sufficient for this purpose. Friction clutches are used for starting and stopping the machine at high speeds, so as to prevent shock and consequent wear. The speed box is planed on the top, in order that the drill may be easily changed from a belt driven machine to a motor driven machine, by the simple substitution of two gears for the pulley. Reversing gears for tapping are provided. All speeds and feeds may be changed while the machine is running even at its highest speeds.

This radial drill is a full universal machine, that is, both the arm and the saddle swivel. This fact should be borne in mind in considering the design. Dimensions of machine are as follows:

Drills to the center of 12 ft. Maximum distance from face of column to center of drill, 77½ ins. Least distance from face of column to center of drill, 22½ ins. Greatest distance from spindle to base plate, 72 ins. Traverse of spindle, 20 ins.

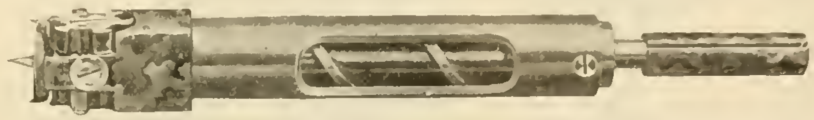
Round, Square or Tunnel Shaped.

Everybody has heard of the auger which bores a square hole; there is one of these in nearly every railroad woodworking shop in the country. The usual way in which these augers make square holes is that the bit bores the circular hole and a square chisel surrounding the auger cuts out the corners. In one sense it does not "bore" a square hole at all.

There is a new tool now on the market which actually bores a square hole, and the proof of this is that the square hole can be driven through iron as well as wood. It is called the Pearl Square Auger and it can make a circular hole, a square hole and a combination of the two, which is a hole like the opening of a tunnel, flat on the bottom with two square corners and an arched top.

The bit itself has cutters suitable for wood and iron, but the principle upon which it operates is the same, no matter what kind of material it is going through. There is the ordinary auger bit the face of which is set at right angles to the center line of the spindle, just like any other boring bit, but the square hole is formed by two milling cutters which revolve parallel to each other just back of the principal cutter and in a plane at right angles to it. Our illustration shows the arrangement. The milling cutters have faces broad enough to take out the corners cleanly. A sharp square hole is the result. Taking off both milling cutters will give a round hole, and taking off one will make the tunnel-shaped hole. A spiral or twist of metal on the outside of the spindle conveys the chips out of the mortise.

This square hole borer is adapted to a great many uses in railroad machine shop work, as by altering the cutters it can be used upon iron or wood as occasion arises. It can be taken out of a machine and the ordinary auger or drill substituted. The square hole auger can do any sort of work which other machines of its class can do, and it also does some kinds of work which other machines cannot do.



THE AUGER WHICH MAKES A SQUARE HOLE.

Special Train Makes High Speed.

The record for speed between the Pacific coast and Chicago was broken last month by a special train from Los Angeles, bearing Mr. Walter Scott, a rich miner, and his wife. The distance over the Santa Fe is 2,265 miles, which was made in 44 hours and 54 minutes. Eliminating 59 minutes for stoppages, the actual running time averaged 51.1 miles an hour. A year ago Mr. Henry V. Lowe made the trip in 52 hours and 49 minutes.

The Railway Consolidated Electric Lighting and Equipment Co., New York, report a great increase in the use of their equipment on many of the leading railways in America. Their "axle light" system consists of a generator installed upon the track of the car, and driven by a broad belt from a double flanged wheel on the axle, a regulator installed in any convenient location in or under the car and a storage battery hung from the car body. The regulator is a contrivance of great ingenuity and takes the place of the governor on steam engines, the effect being that the light is kept at a steady voltage irrespective of the varying speed of the locomotive. The apparatus is also applied to fans for ventilating the cars, and the voltage is so insignificant that no danger can possibly arise from breakage or other causes. There is little or no drag whatever on the locomotive, not exceeding one or two horse power per car, while the advantages are very great, and in a short time will call for a wider adoption.

Larger Quarters.

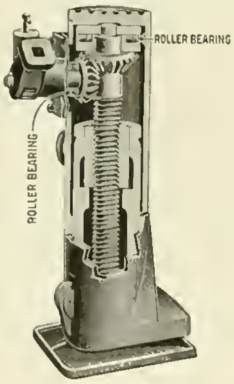
Work has been begun on the roundhouse to be built at Suspension Bridge by the New York Central. The building will accommodate the very largest type of locomotive built. Many of the roundhouses are old timers, and cannot properly house some of the newest type of engines. The repairing of engines in such roundhouses during night in the middle of winter is worse than sledging it with Peary towards the North Pole.

Roller Bearing Screw Jacks.

The Duff Manufacturing Company, of Pittsburgh, Pa., have placed on the market a new and complete line of roller bearing screw jacks and are offering twenty-five or more different sizes. They have other sizes and designs in course of construction. These jacks have been made after a long period of careful designing, and have been put to severe tests in order to prove their ability to stand up to heavy work. These tests have demonstrated the fact that this new type of jack will cause a saving in operating expenses and also in time and labor. It was found that the same load could be raised about 15 per cent. easier with the roller bearing jack than with the ordinary anti-friction screw jack.

DUFF ROLLER BEARING JACK.

The design and construction of these Duff roller bearing jacks are interesting.



SECTION OF ROLLER BEARING JACK.

The jack itself contains two roller bearings; one, the main bearing at the head of the jack, and another bearing to take the thrust on the bevel pinion. The roller bearing used is patented. It consists of two hardened ground tool steel plates with a cage between them carrying the hardened ground rolls. The makers claim that this form of bearing is durable, reliable and most economical, and that the rolls will not crush or flatten and will not wear grooves in the hardened plates, even after long continuous service.

The ratchet on the "Duff" jacks is also of special construction. With this ratchet the jack may be reversed easily and quickly, and the operation is so simple that even the most unintelligent operator is able to understand the entire working of the jack at a glance.

The high standard of the well-known Barrett jacks, which are manufactured by this company, will be maintained in this new line of roller bearing screw jacks. The company are large manufacturers of jacks, and their works at Allegheny, Pa., have recently been materially increased in size in order to handle the great number of Barrett jacks turned out and to provide a special department for the manufacture of the roller bearing screw jacks. The engineering department of the company is continually working out new ideas and experimenting with possibilities in the screw jack business, as well as improving and constantly adding to their already large output of these articles.

The strongest electric locomotive in the world has just been tested on the New York Central & Hudson River Railroad. It is the first of the 40 electric locomotives which are being constructed by the American Locomotive Company at the Schenectady works. The locomotive gained a speed of 70 miles an hour, and with eight coaches attached it ran 55 miles an hour. These electric locomotives are intended for hauling the passenger trains within the electrical zone from the Grand Central depot through the Park avenue tunnel to Croton, a distance of 34 miles, and to White Plains, a distance of 24 miles. The maximum horse power approaches 3,000, which is much more than that of the largest steam engines. The armature is mounted directly upon the axle without any intervening spur wheels, thus eliminating much of the usual motor bearings.

A destructive fire occurred in the roundhouse of the Louisville & Nashville Railway at Nashville, Tenn., on July 6. Six locomotives and the buildings and equipment were badly damaged, the loss being estimated at $30,000. The fire was caused by a tire heating apparatus setting fire to the running board of an engine, the flames rapidly reaching the roof of the roundhouse and enveloping the entire structure in flames. A gasoline tank attached to the tire heating apparatus exploded, scattering fire in all directions. The local fire brigade did excellent work. The work of rebuilding has already begun.

Keep your own counsel and avoid tittle-tattle.—*Martin Chuzzlewit.*

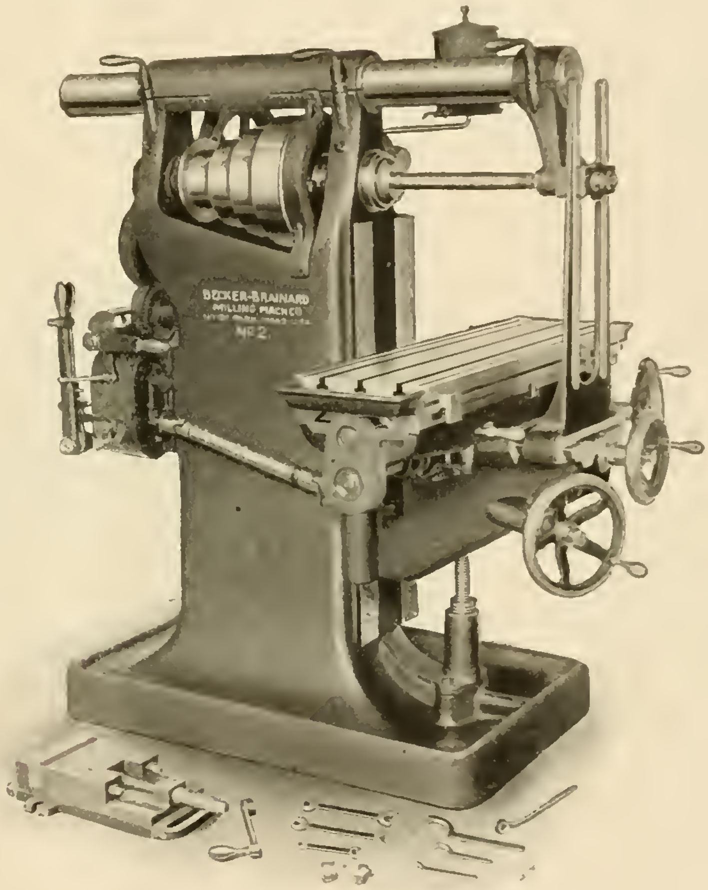
Gear Feed Milling Machine.

The machine here illustrated may be more particularly described as No. 2 gear feed plain milling machine made by the Decker-Brainard Milling Machine Company, of Hyde Park, Mass. In designing this tool particular attention has been given to the requirements of modern manufacturing processes where high-speed production is desired.

A large range of spindle speeds and feed changes have been provided to suit all classes of work. It is suitable for operations where the cutter is to rotate rapidly and work is fed slowly and also where the work moves quickly and the cutter rotates slowly. The knee of the machine has been made very rigid, being of the box type with telescopic elevating screw, and it is heavily supported by cross girders and with broad bearings on the face of the column.

This tool commends itself to users of plain milling machines and attention is called to the positive gear feed drive and change-feed mechanism, which is one of the important features of the tool. Twenty changes of feed can be made without stopping the machine. There is a new clutch mechanism in connection with the hand wheels. The spindle has a No. 10 B. & S. taper hole in front end which is made of hammered crucible steel with a 21/32-in. hole through its entire length. The spindle runs in self-centering bronze boxes arranged so as to compensate for wear. It has a dust-proof cap on its front end, and is threaded to take a clutch, and a threaded collar covers the screw when not in use. The spindle is fully back-geared and the gears are protected with guards.

The arm is made of steel and is designed for horizontal adjustments and has an arbor support which may be removed so that any of the attachments can be placed in position without the necessity of removing the arm. The platen has an automatic longitudinal and cross-feed in either direction, and is provided with three T-slots, the whole is provided with oil channels and pans. It has also a quick return with fine and coarse hand feed. The makers will be happy to send a circular more fully describing this machine, to anyone who is interested enough to apply to them for information on the subject.



GEAR FEED PLAIN MILLING MACHINE.

Considerable interest is manifested in the expectation of the appearance of the large electric locomotive being constructed by the Pennsylvania Railroad Company at its Altoona shops. The new motor will weigh about 100 tons, and is intended for work in the company's underground tunnels.

Slide Valve Leakage.

The question of slide valve leakage is one which has been the subject of much inquiry, and while it has been universally admitted that the complete avoidance of leakage in movable valves is absolutely impossible it has been difficult to determine the amount of loss from this source.

Extensive experiments have been conducted by Professor Capper, of King's College, London, and a report incorporating the results of his experiments has recently been published. From this report it appears that an engine was specially constructed for the use of the professor and committee. The engine was of the horizontal compound type, and although constructed so as to permit of numerous adjustments to provide adequate facilities for investigation, the engine practically represented an ordinary commercial engine.

More than a hundred trials were made, and of these thirty-eight were selected as most closely representing the ordinary conditions. From these it may be gathered that under ordinary working conditions the flow of steam into the cylinder has the effect of lessening leakage from the steam port through the valve into the exhaust, but during expansion and compression the leakage is governed by the difference existing between the expansion or compression pressure on one hand and the exhaust pressure on the other. The correctness of this conclusion was confirmed by experiments which were made with tightly closed ports, the engine being driven by external power, while steam of selected pressures was admitted to the steam chest. The results showed that a distinct reduction of leakage followed adequate lubrication of the sliding surfaces, and that leakage increased with the difference of pressure in the steam chest and exhaust, respectively, and also that leakage largely diminishes with the increase of speed.

Measurements taken with the slide valve in mid position showed much less leakage than when the engine was running, and experiments were made with the valve in nine different positions in order to determine the influence of overlap upon leakage. The variations occurred approximately in the inverse ratio to the overlap. Direct leakage past the piston into the exhaust was found to be about 2 per cent. of the steam supplied to the engine. The escape in this way was found to be independent of the number of revolutions, and remained proportionate to the admission pressure.

With a steam chest pressure of 35 pounds the exhaust pressure averaged 16 pounds. At 145 pounds pressure in the steam chest the exhaust showed nearly 20 pounds pressure. In the one case the leakage per hour showed 11 pounds, while at the higher pressure the leakage per hour footed up to 42 pounds. Exact comparisons in the different data showed that under ordinary working conditions the leakage ranged from 4 per cent. to 20 per cent. of the total steam used. These results being shown in a specially constructed engine where unusual care had been taken to fit the parts and where there had not been cause for irregularities incident to the prolonged friction of sliding surfaces, it is perfectly clear the percentage of loss in a commercial engine must be considerably more.

The result of Professor Capper's lengthened experiments clearly shows that even with well fitted slide valves the leakage is rarely less than 4 per cent. and may reach 20 per cent. of the total steam entering the cylinder, and it is perfectly clear that the question is one which demands the serious attention of engine builders as well as the attention of owners and users alike.

Compression of Steam in Cylinders.

A clearance space between the end position of the piston and the cylinder head is unavoidable, but it is a generally accepted principle that the smaller the space is the less consumption of steam will occur incident to compression. Any irregularities in the action of the valves that induces a compression of steam greater than the pressure of the incoming live steam is of an injurious effect. Repeated experiments have shown that increased clearance means increased steam consumption. A moderate degree of compression in a minimum of space is accompanied with a slight improvement in performance, beyond which there is marked increase in steam consumption. The loss is owing to what may be called the anticipatory condensation of the exhaust steam as its pressure and temperature rises during compression. As Professor Boulvin, an eminent German specialist, has pointed out, "it is more economical to reheat the walls by live steam than by the work of compression, because this work, being derived through a cycle of low efficiency, involves a large expenditure of heat." If the compression exceeds the pressure of the incoming steam the economy of the engine will fall off in proportion to the ratio of compression to that of the live steam.

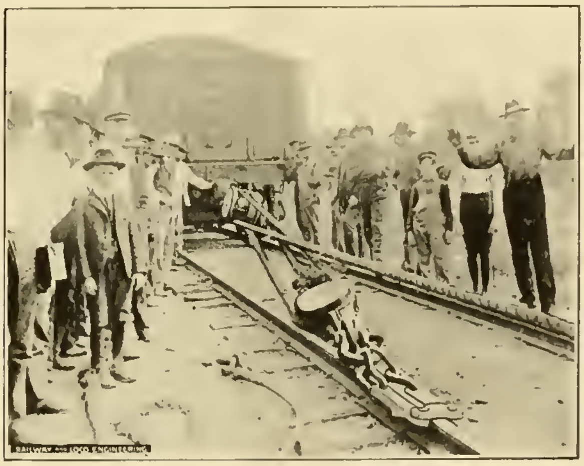
Fifteen new locomotives of the ten-wheel trailer kind are being put into service by the Northern Pacific between Spokane and Pasco. These mammoth engines are designed for the mountain service where they are calculated to haul from 1,600 to 2,000 tons.

Mockery is the fume of little hearts. —*Guinevere.*

New Rail Anchor.

A rail anchor or rail grab for use in railway wrecking outfits is here illustrated. It is a handy contrivance because it is easily applied, and it is safe to say that it never goes far without a place to take hold of when cars are to be put on the track. The anchor weighs a little over 100 lbs. and can be applied or removed in a minute. There is no wear out to it, and it is substantially made, so that there is not much fear of its breaking under ordinary usage.

The Burgess rail-anchor is made with two arms, joined by a cross piece which is secured by rivets, and there are also four chain links. The two arms have each a shoulder or gib on the underside, which catch on the end of a fish plate or rail splice when the anchor is in position. These gibs fit close under the ball of the rail and the act of pulling on the anchor keeps the arms tight to the rails, so that the gibs cannot slip. Only one rail is required for a pull, and if the track is good something has to move, and it will not be the rail anchor.



RAIL ANCHOR.

It is easy to see how much time is saved by the use of a device like this. You can almost throw it into position, whereas the usual way, that of planting a "dead man," or wrapping chains round rails and pulling against ties takes time, and is not by any means a sure thing. Often a tree or stump away off the right of way has to be pressed into service, and that uses up lots of rope and may cause the pull to come at an awkward angle. The Burgess rail anchor insures straight away work every time.

Our readers will notice the arrangement of the block and tackle, as shown in our illustration. The movable pulley or the one with two sheaves in it, is attached to the derailed coal car, while the single block is attached to the rail anchor. This brings the motion of the pulling engine and the car in the same direction, and it gives four subdivisions of the rope to pull with, instead of three, as it would be if the double block was attached to the anchor.

Another Cast Iron Car Wheel.

The breaking of a flange on the wheel of a flat car occasioned the worst railway wreck that has occurred for many years in the State of Connecticut. The car with the broken flange left the rails near the bridge at Perryville. It passed safely over the bridge, splintering the ties as it went. Six other cars then left the track and began tearing up the rails. The train was running about twenty-five miles an hour, and the wreckage extended for several hundred yards. The broken wheel was of cast iron. No one was hurt.

The Merchants' Association of New York City are taking active steps looking toward urging on the members of Congress the necessity of the adoption of reciprocity treaties. This is an important subject, as the principal nations of Europe, following the example of the United States, have adopted or are about to adopt high tariff rates of duty, the imposition of which cannot fail to injuriously affect the welfare of the varied interests of the country. The system of preferential tariff rates to be accorded to those nations that are willing to offer similar reciprocal reductions is one that ought to command the serious attention of our leading statesmen.

The Delaware, Lackawana & Western Railroad Company have just closed a contract with the Vacuum Cleaner Co., of 72 Trinity Place, New York, to equip their new Hoboken terminal with the Kenny system for the purpose of cleaning their passenger equipment, also all the Pullman cars entering there. Mr. Hallett, the manager of the railway department of the Vacuum Cleaner Co., informs us that the plant will be complete in every detail, and will not only take care of all of the D., L. & W. equipment at a great saving of labor and expense, but will greatly improve the sanitary condition of the cars.

The Manchester works of the American Locomotive Company are busily engaged on a large order for locomotives for the Boston & Maine Railroad. They are of the heavy freight variety and will take the place of some of the worn-out stock.

State Inspector of Locomotive Boilers.

NOTES OF THE CIVIL SERVICE EXAMINATION.

BY AN APPLICANT.

In spite of the fact that it had been commonly reported that the member of the New York Legislature who had introduced the bill calling for the State inspection of locomotive boilers had a man ready for the place, and the further fact that the Legislature had failed to make any appropriation for the payment of the salary of the State inspector, it did not deter a score of applicants from appearing on July 15 before the chief examiner and his assistants at the Municipal Civil Service headquarters in Elm street, New York.

The large examination room was nearly filled with embryo bookkeepers, male and female; trained nurses in frills and feathers, be-spectacled statisticians, with other job lots of clerks and apothecaries' assistants thrown in. The boiler inspectors had a corner by themselves. All of the other competitions were in full swing before the typewritten sheets containing the questions were submitted to the boilermakers. One had time to look at his fellow strugglers in the contest. They were mostly men well along in years. Nearly all of them bore marks of facial contact with flying rivets. Battle scars more honorable than saber cuts were plentiful. Hands, hard and horny and hooked like eagle's claws, showed a greater familiarity with "backing" hammers than with pen or pencil. We had six hours to write answers to two "sheets" of questions. It seemed easy, and we all set off together. Quite a few made the fatal error of reading all of the questions over before commencing. This is a sure sign of an inexperienced applicant. One question at a time, with the scrap paper carefully covering the others is enough. Sufficient unto the passing moment is the question thereof. In spite of the clamor of questioning and spelling going on in the three or four other sub-divisions of the battle, some of the boiler inspectors could be heard sighing heavily—not so loud as the passionate exhaust of an overworked freight engine, but deeper and more tremulous.

Indeed, it was a serious matter with questions of such moment before you as how best to describe the effect of electric currents on leaky boilers, and explain in detail the kind of current that can be most successfully used by villainous workmen to deceive ignorant inspectors. When one reflected that in order to be able to describe such blackguardism one must needs have been associating with such reprobates, it was humiliating to have to put in down in black and white. These thoughts mixing with echoes of a loud voiced examiner telling eve-ybody to spell "sieve," and "sibyl," and "subtilty," while still another examiner who loved to hear the echo of his own voice was vociferously stating that if you wanted to eat anything the time so occupied would be counted against you. This took away any little appetite we had. These noises, together with the rattling of cars outside, and the hoarse calling of hawkers hawking their wares, coming in in blatant blasts at the open windows, made a kind of pandemonium differing from, but fully as clamorous as a gang of riveters working overtime on a belated boiler. The effect was to produce a kind of St. Vitus' dance in the bewildered brain, and our little phalanx began to dwindle.

Some stole out quietly as if they had forgotten something. One hard-featured, sober-looking veteran eyed the others askance, as if he wondered what they were writing about. Some of us had finished about half a dozen pages before he put pen to paper. There was a tremor in his hard hands and a cloud of melancholy seemed to settle upon him. He tore a few garbled notes to atoms and departed. There were about a dozen left at high noon and the two sheets were about done and we were inwardly congratulating ourselves that it was not so very hard after all. Vain thought. The first two sheets were only "one," and the "second sheet" consisted of three more closely typewritten pages. There was nothing for it but to proceed.

We had to make sketches in ink of all the kinds of boilers used on locomotives in the State of New York! Sketches of seams, double and triple riveted, sketches of braces and stays had also to be made with front and side views of them. Then there were a whole string of questions about the "throat" of the boiler, that part between the lower stay bolts and the flue sheet, and give sketches of the different kinds of braces used there. Now and again in the thick and throng of ordinary technical questions came curious queries as: How could you determine through the lower gauge cock the height of water in the boiler, when the water had fallen below the lower gauge cock and there was a high pressure of steam in the boiler? Many might think that it would be safest to put out the fire and not waste time experimenting on the exact location of the water, but we live in the twentieth century, and perhaps this condition of affairs would be a good time for the electrician to come along with his X-rays, and try if he could see through a plate of steel; but there were others equally calculated to bring out the sweat, for instance: "How far would you permit the use of tap bolts in closing a crack?" It would take a mind-reader to know what the questioner was trying to get at. Did the question apply to the size of the bolts, their number, their commingling or overlapping, their height or depth, or what? The best thing to do was to write all around the subject and so one might strike accidentally on an answer in the general throng of statements that might meet the requirements of the situation.

Indeed, it seemed from the general trend of the questions that the winner—that is, if the job is not already secured by some one in advance—will likely be the best writer. The great bulk of the questions, nearly a hundred in number, were simple enough to an experienced boilermaker, but nearly all required considerable writing. Details were asked for in nearly every case, and to make anything like completely comprehensive answers would have taken much more than the time allotted. It could easily be seen that the majority of the contestants were not ready writers. Literary expression is not given to every one, and the hunting for words was a harder task to many than the calling up from the subterranean caverns of past experiences the perfect vision of the situation or method of operation called for by the question.

One would have expected questions involving mathematical calculations, but only one solitary question of that kind appeared—the usual formula in regard to the bursting pressure of a certain size of boiler, giving the tensile resistance at 60,000 lbs.

The closing question referred to the fact that as it was impossible for one man to examine all of the locomotive boilers in the State, what would you recommend in the event of your appointment? Here was a chance for the college bred essayist, of which there were, perhaps, three or four. Quite a few never reached that stage of the battle "when the clock struck the hour for retiring." Perhaps half a dozen finished the long list, and whatever may come of it, it was capital exercise, and it would be well for workingmen generally if they were put through such an examination semi-occasionally. It would induce reading and study, and we would have fuller and wiser men. It is but just to add that in an experience of many years in the construction and repair of locomotives, and with a fair knowledge of the generation and harnessing of steam, the perusal of the pages of RAILWAY AND LOCOMOTIVE ENGINEERING, and latterly a single reading of "The Twentieth Century Locomotive," published by the Angus Sinclair Co., furnished me with readier answers to the questions put by the Commission than the experience gathered in the long years of toil incident to half a lifetime spent in locomotive construction and inspection.

Seven Brides on One Train.

Not long ago, as a representative of RAILWAY AND LOCOMOTIVE ENGINEERING was returning to this city, he had the unique experience of seeing seven bridal couples come on board. One bride and groom got on at the starting point and the friends of the happy pair endeavored to make them as miserable as possible before the train started. Rice was used with telling effect, and the irrepressible younger brother of the bride made an ass of himself in the most approved style.

At another station the six other couples succeeded in getting on the train amid showers of rice and confetti. The floor of the car was soon covered with this material, as several of the windows were open, and ladies who had long ago taken their vows before the altar of Hymen were covered with the gaily colored scraps of paper which now does duty for the bonbons once so popular in the Italian carnivals.

This material, this paper confetti, has great clinging properties, and when it takes hold of the carpet in the aisle of a parlor car it defies the broom and the duster. Confetti, however, has an enemy with which it cannot contend. The flat, slot-mouthed, fan-like end of the Vacuum Cleaner Company's dust remover fairly revels in confetti and rice when it finds them upon carpet or curtain or seat; it lifts them up and heads them for the separators at high speed. Confetti has no terrors for the up-to-date car cleaner, armed with the Vacuum Company's apparatus.

Smooth-On Elastic Cement is the latest preparation of the Smooth-On Manufacturing Company, of Jersey City. This is an iron elastic cement prepared in paste form ready for use. Its advantages are that it is metallic and can also be applied to hot iron, the heat causing it to metallize instantly which renders in invaluable for stopping leaks. Their new Smooth-On Elastic Cement Instruction Book will be sent free of charge to any one who writes the company for a copy.

The Simplex Railway Appliance Company has just been awarded a contract for 20,000 truck bolsters, to be used under 10,000 cars to be built by various car companies for the Baltimore & Ohio Railroad. The cars of which these Simplex truck bolsters will form a part are all of 40 and 62½ tons capacity, including box, coal and gondola cars.

A report comes from Chanute, Kan., that the Baldwin Locomotive Works would establish a branch of their works at that place. The extensive areas of coal lands in the vicinity render the project a likely one.

American Locomotives for Europe.

The European visitors to the recent World's Congress of Railway Men, at Washington, D. C., took the opportunity to familiarize themselves with the great power and speed of American locomotives. The result will be that European railway managers will introduce the American locomotive on a larger scale upon their lines. Orders are already being received as a result of the Congress from several of the principal roads as well as orders for locomotives for mines, furnaces, mills and other industries.

A special order has been issued by the Pennsylvania Railroad Company to equip all of their remaining cars with the air brake system. About 175,000 have been already equipped, leaving about 30,000 to complete the equipment. The cost is about $60 a car.

WANTED.—Position by master mechanic with fifteen years' varied experience in charge of large shops. Is familiar with manufacturing and repair work. Would accept position of mechanical engineer, or take charge of manufacturing plant or railroad shop. Does not object to travel. Designing of engine, car or boiler work of all kinds a specialty. Is able to make estimates and specifications, also to supervise work or test material. Address X Y Z, care RAILWAY AND LOCOMOTIVE ENGINEERING, 136 Liberty St., New York City, N. Y.

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Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVIII. 136 Liberty Street, New York, September, 1905 No. 9

New Terminal Station at Atlanta, Ga.

The opening of new branches by the various southern railways and the rapid increase of traffic in the South are among the prominent features of railway development at the present time. This speaks well for southern enterprise, and as a consequence there is a marked improvement manifesting itself in the construction of new terminal stations and other facilities along the lines of the chief southern railways.

Our frontispiece illustration shows a view of the new terminal station at Atlanta, Ga. The building, which has recently been completed, is a handsome and substantial stone and brick structure. The main features are of the Romanesque composite style with ornamental arched entrances. The three upper stories are devoted to the uses of the various railroad companies having terminals there. The building is flanked by two ornate towers which form an attractive architectural feature in that part of the city.

The terminal is used by the Southern Railway, the Central of Georgia Railway and the Atlanta and West Point Railroad. The other roads coming into Atlanta continue to use the old station which was built by, and still belongs to, the State of Georgia.

ATLANTA'S NEW TERMINAL STATION.

A Restful Voyage.

[Editorial Correspondence.]

It has been my fortune to cross the Atlantic ocean so many times that I have lost count of the trips. Until this time there has always been a painful accompaniment of the sea voyages which was witnessing the suffering from seasickness. *Mal de mer*, as the French call it, is not a deadly malady and the sufferers receive little more sympathy than do the victims of toothache, but, nevertheless, those who are not heartlessly callous cannot help feeling compassion for the seasick woes, especially of feeble women and helpless children. One feels different towards strong men, who regard their stomachs as sea-proof and load them up in defiance of Nature's laws. When people of that kind are seen pumping out their overladen stomachs over the ship's rail with many a grimace and groan, pity is wasted upon them.

Like the efforts made to circumvent death, many schemes have been tried to prevent seasickness without much avail until ships have been built big enough to move over rolling billows without motion. Bessemer, the famous steel maker, invented a vessel which he expected would banish seasickness from the packets used for carrying passengers across the Straits of Dover, but he failed. He arranged the vessel with two shells, the inside one swinging level like a compass in its binnacle. When the ship was tried the discovery was made that the dropping motion remained and that is what seems to affect the stomach. The sensation that produces seasickness is felt when an elevator makes a quick drop.

These thoughts on seasickness have come to me because I have just crossed the Atlantic on a vessel carrying about two hundred passengers, men, women and children, where there was not a single case of seasickness during the voyage, although there was some fairly rough weather. The cause of this very desirable condition of affairs is the size of the vessel, which nothing short of tremendous side waves will bridge. It is the Minnehaha, of the Atlantic Transport Line, 610 ft. long, 65 ft. beam (width), and drawing 26 ft. of water. The hull is so long—about two New York city blocks—that it reaches over two or three big waves, and has no tendency to rise and fall by their action.

In my previous trips I have always tried to select fast liners that would make the voyage as short as possible. Fast liners vibrate so badly that there is no nerve rest for the passengers and there is such a tumult from start to finish that no relaxation is possible. President Underwood, of the Erie, talking on this subject, remarked that he went abroad for a rest and, owing to the ceaseless vibration, landed more fatigued than when he started.

Well, I took a nine-day boat and enjoyed the most satisfying rest that has been mine for many years. Mark Twain never tires of telling about the reposeful trip he made over the plains in the ante-railroad days on a wagon loaded with mail sacks. I don't think it could compare to a nine-days' trip over the Atlantic on a vessel that skimmed along like an ice yacht with luxurious cushions and comfortable beds to repose upon.

To me the conditions of life on board this ship are ideal. There are very few rules staring people at every turn, as is the practice on most passenger vessels. The people are permitted to wander about almost where they please, which enables them to overcome the monotony that must be inseparable from a sea voyage. If one feels so inclined, he can walk all round the deck, and four turns make a mile, or he may take part in a variety of deck pastimes provided for the amusement of those on board. Then there is the intense excitement of seeing a whale spout at long intervals, or of watching for flying fishes, nautilus, or other creatures that make their home on or in the briny deep.

These mild pastimes chase the fleeting hours and there are more familiar amusements indulged in in reading room, smoking room, and other places of indoor resort.

All has passed merry as a marriage bell, but there has been one fly in the ointment. The habitats of a ship form a miniature world in themselves, and all elements of populous life might be identified by careful research. The bores are in strongest evidence everywhere, their tortures being concentrated on ship board, and their presence seldom fails to mar the harmony of a passenger list. We have them here.

Our Mr. Optimist follows the business of stimulating public morality and he was holding forth on the glorious blessings enjoyed by mankind and of the greater glories that are to keep multiplying for ages through the progress of science and fertility of men's inventive powers. He pictured in glowing words the wonderful advances in the production of new appliances calculated to increase the sum of human happiness, the millennium that God's inspiration to move was hurrying to consummation.

"You are all off," remarked Mr. Pessimist. "The people of the present day are wasting the bounties intended to spread over ages and the earth's inhabitants of the near future will be left without the enjoyments based on the use of coal and iron. Do you know, my friend," he continued, "that at the increasing rate of present consumption coal and iron ore will be exhausted in 250 years?" This was one of the men who revel in statistics and he was prepared to prove the assertions he had made.

This was an alarming statement, for two centuries is a small spot in time, and it will be a sad condition of affairs if the people two centuries hence have to enter upon the backward journey that will make mankind depend upon stone implements and weapons.

It may be that long before coal becomes exhausted, inventors will succeed in harnessing the mysterious aerial forces that convey wireless telegraphy, and turn them into the services of the human family. If something of this kind is not done the people of only a few generations hence will be in a bad way. Of course, self-preservation would lead to the cultivation of forests, but trees grow slowly and a social cataclysm would likely happen before people could adjust themselves to the new conditions.

Mentioning wireless telegraphy reminds me to speak of the wonderful progress making with the Marconi system of communication. There is a station on this ship, and they have been receiving and sending messages almost daily during the whole voyage. They have already established communication with passing steamers and notice is given to the passengers that messages will be received for transmission to certain passing vessels and these in turn get them transmitted to the nearest land station. Messages were received from several vessels that did not come within two hundred miles of our ship.

There is much talk heard about the benefits people are going to derive from the use of wireless telegraphy, but I think the blessing has its drawbacks, especially for worn-out men of wearing business, who take a sea voyage for recuperation of wasted energies. Under the old state of affairs he could enjoy a week of uninterrupted rest without thought or knowledge of business. The market for stock or commodities might rise or fall and he would remain blissfully ignorant. Under advanced practice he will receive market reports along with his breakfast menu, and will never be really clear of business cares.

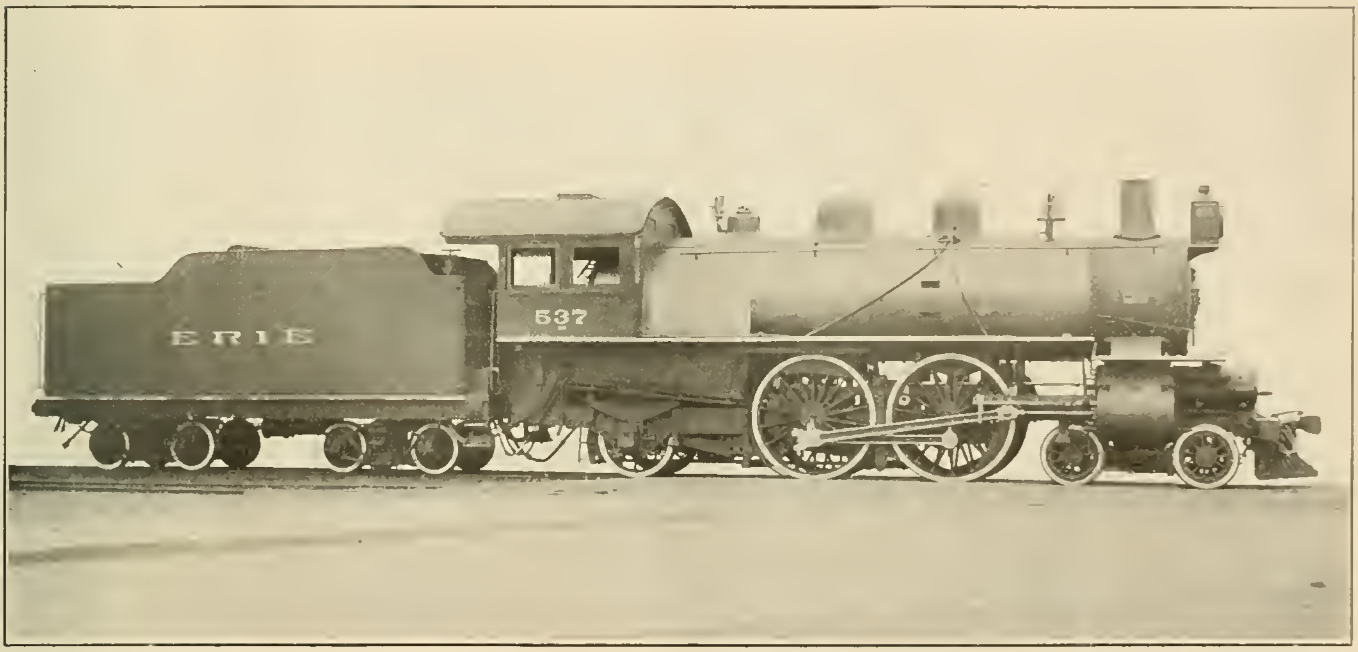
There is a tradition among railway men that an American railroad magnate while crossing the Atlantic on a liner watched the unceasing work done by the engines of the ship and concluded that there was no reason why locomotives should not be kept constantly at work, taking up a new trip as soon as one was finished. He had sufficient influence to put his ideas into practice with the result that pooling of locomotives was introduced. That was a case of jumping at an important conclusion without proper evidence.

To look down under wide gratings into the entrails of a huge ship and watch the steady movements of ponderous engines gives no idea of what goes on below. The onlooker gets as imperfect an idea of the power of machinery as the distant beholder of a railway train does of the forces brought into action to produce the speed. I do not know of any large machine that receives the same incessant attention enjoyed by a marine engine. All the time it is at work attentive eyes are watching its movements, ears trained to detect the least discordant note are always listening to its rhythm of labor. When it stops at the end of a voyage every vulnerable part is critically examined, every distortion of wear is rectified and all loosened joints or connecting appliances made tight. The machine starts out on every voyage as good as new and works its trip free from grit and changes of temperature.

Compare these conditions with those endured by a locomotive during its working hours. Upon it the wind is constantly wafting all sorts of abrading substances, some that cuts like carborundum is driven into the bearings, water thrown with irresistible force is injected into every box, collar and gland, washing away the lubricants. Too frequently, when the overworked engine reaches the end of one journey it is immediately started out upon another one with very little inspection and no cleaning. If the engines were sentient it would be a stupid one which would prefer the hard drudgery of a locomotive to the aristocratic working conditions of a marine engine.

Some things I have observed while lounging about the promenade deck have moved me to reflection. When we had got a day out on the voyage the vessel seemed to be what I was accustomed to hear described in my seafaring days as "ship shape." The decks were clean, the paint was bright, and very few bald spots could be detected upon protected parts. Yet we were barely out of sight of land when a fury of scrubbing, wiping and painting began that lasted all the voyage. My mental inquiries were, how does all that pay? Its immediate reward was good in cleanliness and neatness, but these virtues do not earn money directly. The owners of the line are no fools and probably know what they are about, but I could not help contrasting the conditions with the spirit that dominates the care of locomotives where cotton waste is doled out very grudgingly, and no more than absolutely necessary expense for labor is allowed. Cleanliness appeals to passengers and they are much more likely to be patrons again where such conditions exist. Now does it not seem rational that passengers would prefer a railroad where the locomotives and cars are clean and attractive than those where somber filth is the rule?

Some of our railroad officials have taken much credit to themselves for stripping locomotives of all ornamental trimmings and fancy painting. I wonder why they do not pursue the same policy concerning cars. They are afraid that homely looking cars would not pay. It is a question in my mind if the dirty locomotive pays. The Delaware, Lackawanna & Western people keep their switching engines brighter and cleaner than the passenger engines of most railroads and I attribute the growing popularity of the Lackawanna route to that, among other attractions. A. S.



ATLANTIC TYPE FOR THE ERIE.

Geo. W. Wildin, Superintendent of Motive Power. American Locomotive Company, Builders.

Balanced Compound for the Erie.

We take pleasure in reproducing illustrations kindly furnished by the American Locomotive Company, who has just completed a locomotive from designs furnished by Mr. Francis J. Cole, the mechanical engineer of the company. Its main features embrace all of the admirable qualities of the Atlantic 4-4-2 passenger engine, with a greater degree of neatness and safety in the arrangement of the valves connecting the cylinders. The two low pressure cylinders are placed in their usual position outside of the frames and are 26x26 ins. The two high pressure cylinders are placed inside the frames and 45½ ins. in front of the low pressure cylinders, and are 15½ ins. in diameter by 26 ins. in length.

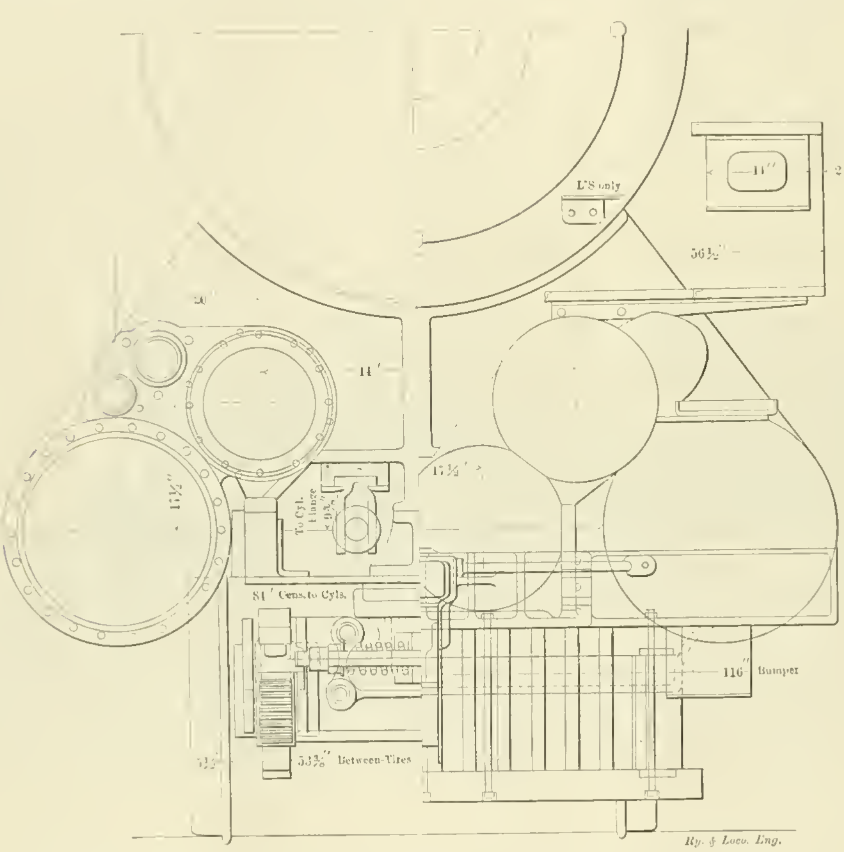
The method of balancing the force of the locomotive is maintained by the arrangement of the cranks, as when the piston in the low pressure cylinder on the right side is at the front end, the piston in the high pressure cylinder is at the back end of the stroke, at the same time the cranks driven by the pistons of the high and low pressure cylinders on the left side are so adjusted that the crank is at the top center on the high pressure cylinder, and at the bottom on the low pressure cylinder, the pistons of the outer cylinders driving the back axle to which the eccentrics are attached, while the pistons of the high pressure cylinders are attached by main rods to cranks in the front axle.

The valve gear is consequently of the indirect type, and the valves of which there are four, one for each cylinder, are of the outside admission, piston kind. The distance between the two axles being 84 ins., ample room is afforded to reach the valve gearing. The diameter of the wheels is 78 ins., and the counterbalancing of the forward wheels is of the double system of weights, so adjusted as to meet the weight of the connecting rods and crank pins as well as to meet the counterpoise of the inner cranks and couplings attached to the axle.

Mr. Cole has perfected the excellent features of inclosing the crossheads attached to the high pressure pistons, thereby avoiding the clogging of dust on the working parts of the crossheads and guide bars. He has also adopted a new method of placing the by-pass valves under the cylinder in such a position that they are entirely free from damage consequent on their usually exposed position on other compound and double-acting engines.

The entire length of the locomotive is 41 ft. 2½ ins., and the height from rail to top of stack 15 ft. 2¼ ins. The boiler is of the straight top kind, the barrel measuring 18 ft. in length by 72 ins. at the smoke box end. The fire box is 71 ins. wide bv 9 ft. in length at the bottom, with an average height of six ft., the front of the bottom of the fire box being 9 ins. lower than the back.

The wheel base is 28 ft. 9 ins., and with 225 lb. pressure of steam the calculated tractive effort would be about 24,-400 lbs. The weight on the driving wheels is 115,000 lbs., making the coefficient of adhesion 4.7, and the total weight of the engine is 206,000 lbs.



SECTION SHOWING CYLINDER ARRANGEMENT OF ERIE ENGINE.

Economy in the Use of Coal.

Mr. C. F. Richardson, of the Chicago & Eastern Illinois Railroad Company, read a paper before a meeting of railroad men at St. Louis recently, from which we make the following extracts:

"The engineer should be held responsible for knowing that the fireman keeps the grates properly shaken and ash pan cleaned so that fire will be in good condition for getting the proper combustion from the gases of the coal. The fireman should understand that he is subordinate to the engineer, who will direct him in the economical use of coal. He should be instructed in the method of smokeless firing, and should be given to understand that he will be expected to practice this as far as possible, and that it will be his duty to know that the grates are in good condition before leaving terminal, and the ash pan clean. On arrival at engine after being called to go out, the condition of the fire should be looked after. If necessary to build fire up, it should be done gradually by putting in a small amount of coal at intervals so that the gases can be consumed, thus avoiding the use of the blower as much as possible. The fireman should keep himself informed as to the exact leaving time, and get the fire in shape so the steam pressure will be about at the popping point when ready to leave. He should fire the engine evenly by spreading a shovel of coal over the grates then closing the door, and so on, putting in coal at intervals as required to keep up a full pressure of steam. He should keep the grates shaken sufficiently to keep the fire light and in good condition to admit of a free circulation of air through the fire so that perfect combustion can be had. Too much cannot be said in regard to engine crews keeping their fires in good condition. The fireman should understand that his promotion depends upon the efficiency of his work.

"I believe this, that if we keep after the firemen and engineers and keep before them the large expense that the company is to in buying coal and what it amounts to, we can accomplish much good. It is not the tons we want to save, it is the shovelful, and there is hardly an engine going over this road that with careful firing one shovelful of coal could be saved every mile. That is not very much, but for 100 miles it is 100 shovelfuls, and that is about one ton of coal, which is equal to nearly the fireman's salary. If we will get the men interested and make them think it is not big ton we want but the shovelful we want saved, they will realize it then. You cannot make a fireman save a ton at once, but he can save a shovelful."

New York and Davenport.

The "Twentieth Century Limited" has not only been instrumental in shortening the time occupied in traveling from New York to Chicago, but the electricity of action seems to have caught on in the minds of the managers of the various roads westward of Chicago. The city of Davenport, Iowa, can now be reached in 22½ hours from New York. It will be remembered that Abraham Lincoln, in defending a suit against the promoters of the first bridge across the Mississippi between Rock Island and Davenport, prophesied that in a few years there would be more people crossing the river by rail than there would be passengers sailing up or down the river. Mr. Lincoln had the seer's vision, but he could hardly have foreseen what the wonderful service of the New York Central Lines were to accomplish in the development of the commerce of the United States.

A new structure to house the test plant of the Pennsylvania Railroad is in course of construction at Altoona. It will be a large building built of brick and steel, with a slate roof. It will have three tracks. The plant is the same that the company had on exhibition at the St. Louis World's Fair last year. All of the new locomotives will be tested at this plant before being sent out on the road.

Heating and Ventilating Roundhouses and Repair Shops.

Among the many questions discussed at the Master Mechanics' convention at Manhattan Beach this year there was none of greater importance to those engaged in the repair of locomotives than the subject of the proper heating and ventilating of roundhouses; and it is particularly gratifying to observe that as the fall approaches there are many indications that the roundhouses will not be so poorly provided for in that regard as in past years. This is particularly the case with the great trunk lines in the Northwest, where the winter is, perhaps, severest; but there is no place in this broad land of ours where the improvement in the sanitary condition of roundhouses has kept pace with other important matters, and where there is not a crying need of the adoption of radical changes.

From a mere business point of view the time wasted, and consequent loss, in thawing portions of the engines to be repaired, where there is no method of keeping a roundhouse or repair shop at a moderate temperature, is very considerable. Apart from this, there is a humanitarian side to the question which, perhaps, does not appeal so strongly to men who are accustomed to the carpeted floors and polished surroundings of office buildings as it does to that larger army of skilled artisans who go down into filthy roundhouse pits and break the clustering icicles from rock-ribbed machinery, and feebly clutch with frozen fingers at the parts to be repaired. Skilled mechanical work of the best kind under such conditions is a physical impossibility. Nothing but a mere temporary makeshift is attempted, and nothing but further disaster should be expected.

In addition to the heating of roundhouses we are pleased to observe that at several of the larger railroad repair shops complete equipments are being installed with a view to heating and ventilating the various departments. The accompanying illustration shows a view of a portion of the shops at East Moline, Ill., where the B. F. Sturtevant Co., of Hyde Park, Mass., has installed a complete system for the Chicago, Rock Island & Pacific Railway. It consists of a number of blast wheels in full steel plate housing. The fans are top horizontal discharge, arranged to draw the air from the shops through heaters containing about 10,000 linear feet of 1 in. pipe built up in sections arranged in double groups and inclosed in a steel plate jacket connecting with the fans which are driven by belts from independent motors. The distribution of air is made through a system of overhead galvanized iron piping suspended upon the roof trusses and provided with down projecting outlet pipes having double discharges and located at proper intervals.

HEATING APPARATUS IN THE SHOPS OF THE CHICAGO, ROCK ISLAND & PACIFIC RAILWAY.

Wireless Telegraphy on Railway Trains.

Interesting data has been already gathered from the experiments made with wireless telegraphy on the Chicago & Alton Railroad. It appears that as the trains approached the Mississippi river the increase in the strength of signals became very marked, but when the train entered the truss of the Merchant's Bridge it was found that signals died away almost entirely, owing to the screening action of the truss. The signals were also stronger when the train was running at right angles to the transmission station. That the radiations followed the course of the river rather than overland was particularly marked. The success of the tests is such that, it is said, it has been decided to install the wireless system of telegraphy permanently in some of the trains, and it is expected that the transmission stations will be able to keep in continuous communication with these trains during the entire length of their run.

Teaching a Servant.

Governor Douglas, of Massachusetts, tells a story of a benevolent-looking friends of his from the center of the State who was walking along the road from Northampton to Amherst one day and saw a rural-looking man sitting on a stone wall swinging his legs and gazing earnestly at the telegraph wires which were humming busily in the wind over his head. Desiring to rest awhile he saw a chance for company. Going over to the yokel, he said:

"Watching the wires, I suppose? Waiting to see a message go long, eh?"

The man on the wall grinned and said, "Ay."

The benevolent-looking man got on the wall and for the next quarter of an hour tried hard to dispel his ignorance.

"Now," he said at last, "you know something about the matter, don't you? And what's more, I hope you spread your knowledge among your mates on the farm."

"But I don't work on a farm," replied the rural citizen.

"Where, then, may I ask?"

"You see, me and my mates are telegraph linesmen."—*Philadelphia Ledger.*

Important Improvements on the B. & O.

The rapid increase of traffic has compelled the Baltimore & Ohio Railway Company to make important extensions of their double track system. These improvements embrace new sections, whereby the old single lines will be abandoned and portions of curves shortened and grades at several points reduced. The work involves the construction of three new bridges. It is expected that the improvements will be completed in about a year at a cost of over $600,000.

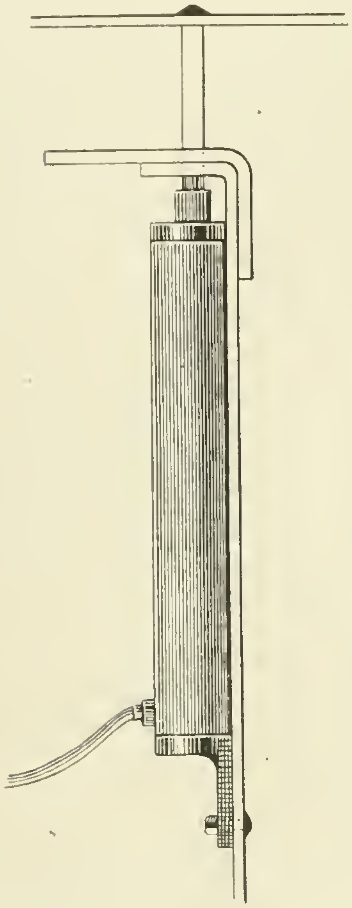
Traveling Engineers' Association.

The thirteenth annual convention of the Traveling Engineers' Association will be held at Detroit, Mich., on September 12. Mr. W. O. Thompson, the accomplished and genial secretary, assures us that the convention will outdo any of its predecessors. The Michigan State Fair will be held at Detroit during the same week, and there will be no lack of local interest.

It may be proved with much certainty that God intends no man to live in this world without working; but it seems to me no less evident that He intends every man to be happy in his work.

Among the Railroad Shops. At Pittsburgh.

As we approach Pittsburgh the cloud of smoke in the dim distance looks black and forbidding. As we get nearer it takes on a ruddy glow like burnished copper, and then melts into amethyst,



REDDING'S ADJUSTABLE HOLDER-ON.

like the dim shadow of a summer cloud, when we get into the heart of it.

A morning call at the shops of the Pittsburgh & Lake Erie Railroad was a call to be remembered. Mr. D. J. Redding, the accomplished and courteous master mechanic, showed us through the extensive and finely equipped works. The shops are a model of their kind, and the number and variety of labor saving devices are remarkable, even in this wonderfully inventive age. In the great machine shop, 575 ft. in length by 170 ft. in width, there are over seventy machines, all the best of their kind, run by electric motors. These separate motors have the fine feature of being variable in their speed, thereby avoiding nearly all of the cones and pulleys and belts common to other shops and other years. Indeed, it would be next to impossible to run such a shop with the old-fashioned shafting hung along the roof trusses, as one can readily imagine the great loss of power that would be incurred in turning a shaft 600 ft. in length. The tool department is the most perfect of its kind that we have ever seen, and it would be well if many of our leading mechanicians in New York and vicinity could mark the perfection with which Mr. Redding's able workmen have stocked the tool room with every conceivable tool, ready at a moment's notice for use.

A system of tool checks is particularly worthy of imitation by those who adhere to the antiquated notion of loading the pockets of the mechanic with checks. A large blackboard in the tool room is the general custodian of all tool checks, and it can be seen at a glance where any required tool may be found at any time.

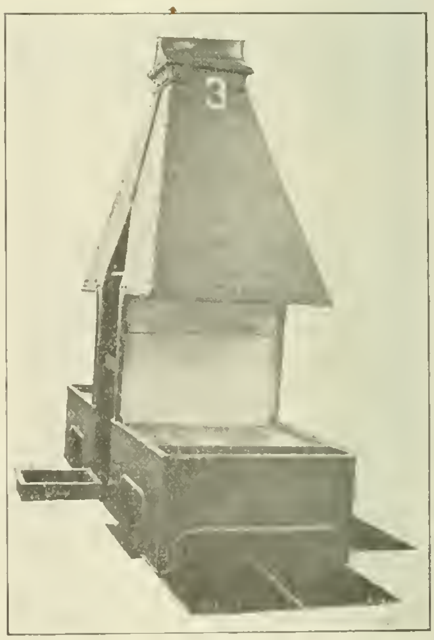
Of Mr. Redding's own labor saving devices there is no end. Here is a strong, simply constructed rack adjustable to the height necessary when flues are taken out of a boiler. The flues never reach the ground. When the rack is filled a traveling crane comes along and the load of flues is carried to the cleaning and welding furnace. In some shops flues are handled as often as fifteen times. With Mr. Redding's appliances they are never handled once. The removing, the carrying, the cleaning, the welding and placing back in the boiler is done by compressed air. In the welding of flues Mr. Redding is a believer in the butt weld. The long end is slightly opened on a mandril, while the short piece, cut off in the usual way without tapering or scarfing, is readily and securely welded without any burning of thin edges or weakening back of the weld.

A movable ash receiver surely may be said to fill a long-felt want. Locomotives are placed over an extensive pan lowered in the ash pit, and the ashes from the locomotive are dropped in the pan. A movable crane overhead lifts the pan, which is of the automatic emptying kind, and the ashes drop into a car. The actual saving of the time in the use of the cars alone amounts to thirty dollars per day. Then there is no shoveling, nor cooling, nor freezing. The ashes disappear in a few seconds as if by magic. This excellent labor saving device is from designs by Mr. Redding, the plant being manufactured by Messrs. Heyl & Patterson, of Pittsburgh. Of automatic sand drying plants and coal and sand filling plants there are perfect working apparatus in operation, and in the wheel and axle section we observed a new register in operation whereby the pressure of any axle less than the required minimum standard was promptly registered. A system of strong adjustable trestles for supporting engines after the wheels are removed are also in operation, thereby avoiding the carrying and placing of heavy wooden blocks, a system still much in vogue. These trestles are fitted with strong screw jacks with which an engine frame may readily be leveled.

Mr. Redding's ingenuity has also run into the boilermaking department. Here is an adjustable "holder-on," whereby in the inner edge of the crown sheet, where it is extremely difficult to hold against a stay bolt or rivet, an air cylinder with a piston in one end and a hole in a foot at the other is easily bolted to any suitable open rivet hole and the adjustable piston squarely set against the end of the stay bolt, air pressure from a detachable pipe furnishing the resistance.

In the blacksmithing department, Mr. A. W. McCaslin very ably supplements the worthy master mechanic. The shop is a marvel of cleanliness and comfort. Mr. McCaslin has patented an improved blacksmith's forge which has many advantages. It is made of cast iron, is very compact, complete and durable and needs no repairing. Partitions for coal and coke are under the forge. There are no unsightly boxes or tanks, and free access is allowed from all sides. The forge is double, the space between the two is occupied by the blast valves and by shelves holding the necessary tools. An ingenious contrivance of Mr. McCaslin's also is a drop forge, whereby the fire is readily dropped from large pieces of work when in a state of fusion and immediate application of the hammer is necessary.

These are but a few of the many marked improvements in operation which we observed, and which greatly facilitate the operations of the 470 skilled



McCASLIN'S PATENT DOUBLE FORGE.

workmen in the shops. There are about 650 engineers and firemen who keep in almost continuous work 182 locomotives. There are about a dozen more engines in course of construction, and with their excellent facilities the company is able to do a great deal of work for other roads having terminals at Pittsburgh, and considerable rebuilding and repairing is being done for the New York Central, Lake Erie, the Monongahela division of the Pennsylvania R. R., besides nearly all of the work incident to the repair of the engines of the Union R. R. of Pennsylvania.

We may add that we were particularly pleased to observe the general air of comfort and content among the workmen. Their interests and the company's interests are mutual and reciprocal, and Mr. Charles McGowan, the scholarly and gentlemanly clerk of the works, gave us assurances that the high degree of intelligence and efficiency among the best class of artisans was owing in a great measure to their close study and attention to the various features of RAILWAY AND LOCOMOTIVE ENGINEERING, and especially to the correspondence department.

Largest Switching Engine in the World.

The Lake Shore & Michigan Southern Railway has just placed in service the largest switching engine yet built, and it is the first of a number that are in course of construction in the Brooks Works of the American Locomotive Company. As will be seen by the accompanying illustration, the engine is of the 0-10-0 kind. The small diameter of the wheels, 52 ins., gives this splendid engine the advantage of great tractive force aggregating 55,352 lbs., the short wheel base, 19 ft., tending to increase the adhesive quality of the engine. The colossal dimensions of the boiler, which is of the extended wagon-top kind, afford ample room for the generation of steam, the diameter of the barrel of the boiler at the first ring being 80 ins. The number of flues is 447, 2 ins. in diameter and 19 ft. in length. The boiler is radial stayed, with a fire space measuring 9 ft. in length by 73¾ ins. in width, giving a total heating surface of 4,625 sq. ft. The shell of the boiler is 11/16 in. thick, and the sides of the fire box and crown sheets are of ⅜ in. steel, while the tube sheets are of ½ in. steel, and are calculated for a working pressure of 210 lbs.

The cylinders are correspondingly large, being 24 ins. in diameter with a piston stroke of 28 ins., the diameter of the piston rod being 4¼ ins., the piston packing is of the cast iron snap-ring variety. The engine is furnished with 12 in. piston valves traveling 5⅝ ins., with a steam lap of 1 in. There are a full equipment of Westinghouse air brakes with air pump 11 ins. in diameter and double reservoirs, one measuring 18½ ins. by 120 ins., and the other 24½ ins. by 72 ins.

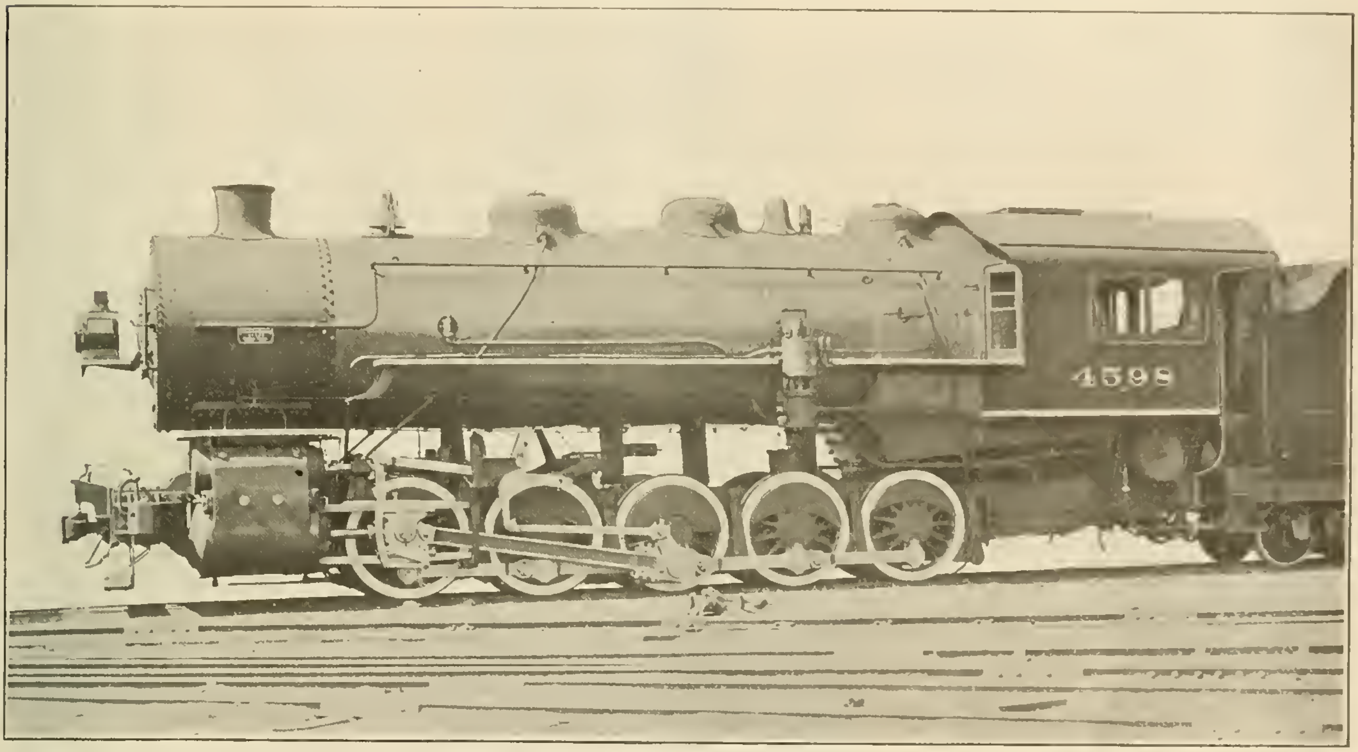
The smoke stack, which has a diameter of 20 ins., is at the highest point above the rail, 14 ft. 10½ ins. The tank is of the water bottom variety with a capacity of 6,000 gallons and accommodation for 12 tons of bituminous coal.

The axles and bearings are proportionately large and of the best material, the journals of the main axles measuring 10½ ins. by 12 ins., the other axle bearings measuring 9½ by 12 ins., the truck journals measuring 5½ ins. by 10 ins.

It will be noticed from the illustration that the entire weight of the engine is equally distributed on five driving axles, the aggregate weight of the engine being 270,000 lbs. This enormous weight, amounting to 54,000 lbs. on each of the five axles, is not approached by any other locomotive with the exception of one of the Mallet type recently built for the Baltimore & Ohio Railroad. The total weight including the tank and in working order is 419,000 lbs. The total length of the engine and tender is 54 ft. 5½ ins.

The wheels are all flanged, and the axles being 57 ins. apart from center to center, the builders have furnished the engine with the Walschaert valve gear, which is well adapted to such a design, as it would be difficult to find room for the ordinary Stephenson valve gearing inside the frames of an engine so constructed. This also gives opportunities for a better system of frame bracing which has been taken due advantage of in this powerful switching engine which is intended for the heavy work of pushing trains over the "humps" in gravity yards, of which the Lake Shore & Michigan Southern have a very considerable number.

We are confident that this engine will accomplish all that is expected of it and redound to the enterprise of the owners, and to the ingenuity and skill of the designers and constructors. As a combination of great strength and simplicity



HUGE SWITCHER FOR THE L. S. & M. S.

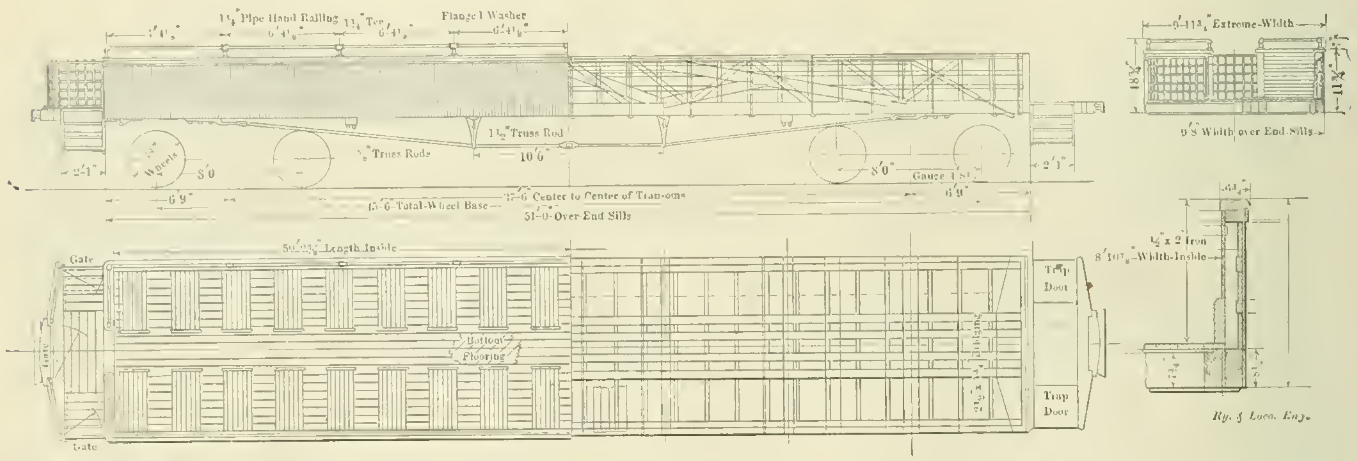
H. F. Ball, Superintendent of Motive Power. American Locomotive Company, Builders.

of design it is a notable advance in the building of switching locomotives.

Observation Car on the Denver & Rio Grande.

Tourists who have had the opportunity of visiting the Grand Cañon of Colorado will have observed the difficulties under which the marvelous spectacle of the towering palisades can be witnessed from an ordinary passenger car. In the Royal Gorge the sublime panorama passes overhead and the Denver & Rio Grande Railroad Company have acted wisely in constructing a number of open top observation cars. Three of these cars, built at the company's shops at Burnham, are already in service, each car accommodating eighty passengers, and it need hardly be said that they are meeting with the universal approval of the delighted passengers. As will be seen from the accompanying illustration, the car is admirably adapted for the purpose in view. The seats are malleable fixtures with wood slats. The interior width is 8 ft. 10⅞ ins., and the height of the sides of the car from the floor is 32 ins., surmounted by a brass handrail of 1¼ in. polished brass pipe, 7 ins. in height. The interior finish is poplar painted, and the cars are elegant in appearance and commodious in design. The length of the car over end sills is 51 ft. and width over sills 9 ft. 8 ins. The platforms are of standard steel. The four-wheeled trucks are furnished with Westinghouse quick-action brakes. The wheels are of the Paige steel-tired variety, 38 ins. in diameter, with axle journals 4½ ins. by 8½ ins.

The example set by the Denver & Rio Grande might well be followed by other roads passing through mountain gorges where a comprehensive view of scenery is a physical impossibility except from the platform of the rear car which is usually pre-empted by some foreign visitor or local functionary. The new observation open-top cars of the Denver & Rio Grande cannot fail to aid in popularizing the amazing spectacle of the Grand Cañon, which in its colossal grandeur is unapproached by any similar natural phenomena in the known world.



SECTIONAL ARRANGEMENT OF OBSERVATION CAR ON THE DENVER & RIO GRANDE RAILROAD.

Railroad Conference at Detroit.

A unique gathering is to be held at Detroit, Mich., from September 28 to October 1, inclusive, composed of railroad men from all branches of the service, who come from all parts of North America. These men will come together for conference on the work of the Young Men's Christian Association.

Prominent railroad officials and speakers of national reputation have already been secured to address this great gathering of men. The meetings will be largely inspirational and the music will be a feature, with quartettes and glee clubs from various associations as well as a good sized orchestra composed of railroad employees.

The conference will open on Thursday afternoon, September 28, at 3 o'clock, and will close on Sunday evening, October 1. On Friday noon fifty or seventy-five shop meetings will be held in all parts of the city of Detroit; these will be conducted by the visiting railroad delegates and will be short, bright and interesting meetings. Probably no city is better equipped for conventions than Detroit. All such gatherings held there attract a great deal of local interest and this conference of earnest, energetic railroad men will be no exception to the rule.

On Sunday there will be a vigorous campaign all through the city; the morning services at about seventy-five of the churches to be conducted by the delegates, a large mass meeting in the Light Guard Armory for men in the afternoon, closing with a farewell service in the Central Methodist Church in the evening.

There are now about two hundred and ten Railroad Associations throughout North America, with a membership of seventy-five thousand. Almost all of these associations will be represented, and delegates will also come from a number of unorganized points on the lines of the various railroad systems.

Railroad men who are interested in this conference and would like to attend are requested to write to the local or State secretaries of the Young Men's Christian Associations, or to the Railroad Department of the International Committee at No. 3 West Twenty-ninth street, New York, from whom full particulars may be secured.

Destructive Fire at the D. & L. Depot.

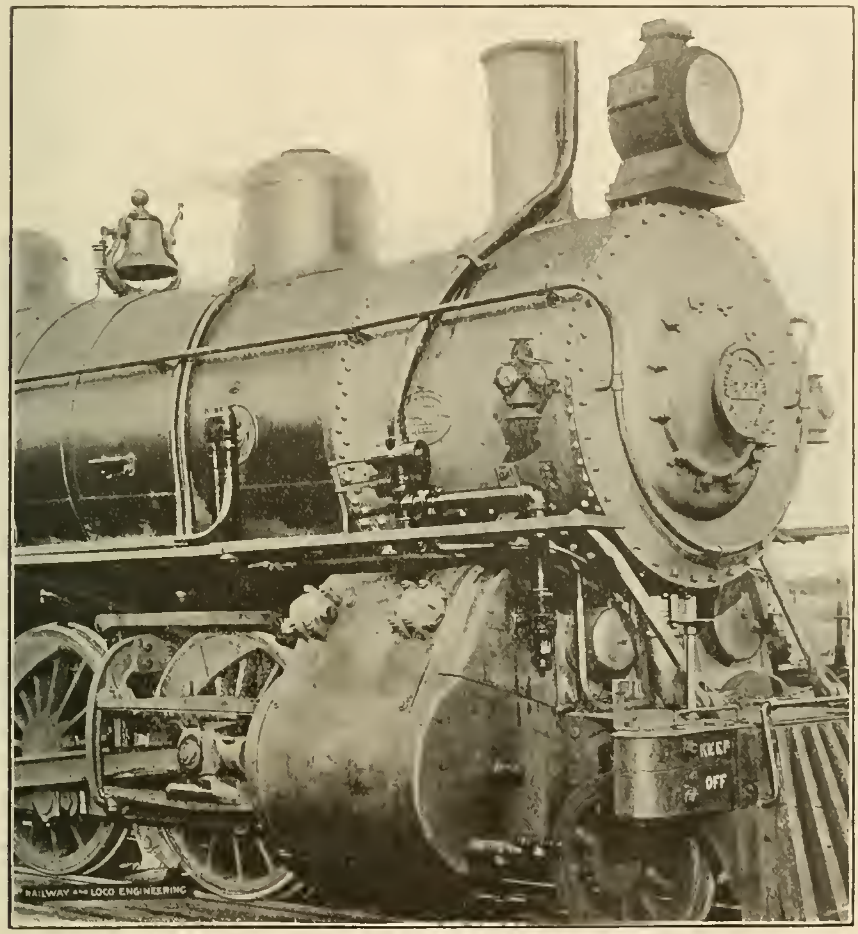
The complete destruction by fire of the Delaware & Lackawanna passenger depot at Hoboken, N. J., last month, with the ferry houses and ferry boats, and train sheds and buildings adjoining the station has been a very serious blow to the railway company. The total loss is estimated at $1,500,000. Every railroad company in New Jersey came promptly to the aid of the D. & L., and the inconvenience to the public was of short duration. The fire started by an explosion at midnight on the ferry boat Hopatcong which had been moored in the lay-up slip. The cause of the explosion is unknown, as the boat is entirely destroyed. Two watchmen are missing and are supposed to be burned.

Silence Is Golden.

The efforts being made by the Pennsylvania Railroad Company to prohibit unnecessary noises during night is worthy of all praise. Blowing of whistles, and clanging of bells, and the blatant calls of bewildered brakemen are not conducive to balmy sleep. The strenuous life is a grand thing, but a good night's sleep is better.

The Wheaton Variable Exhaust.

The problem of lessening the tremendous draft in a locomotive, which so affects the flues and flue sheets, without interfering with the steaming qualities of the engine, is one which has engaged the minds of many of our inventors. The reduction of the back pressure in the cylinders to a minimum has also been a source of anxious thought, and while the results of the various contrivances have not always been as successful as might be wished, undoubtedly progress has been made along these lines of inquiry.



ENGINE SHOWING THE WHEATON VARIABLE EXHAUST.

One of the most recent and, perhaps, the most important device looking toward lessening these obvious drawbacks is the Wheaton variable exhaust, the chief object of which is to allow, at certain times and under certain conditions, the exhaust to escape through a separate pipe outside the chimney, the idea being to cause a mild and even draft of just sufficient force to cause the coal to burn properly and to make the engine steam properly. By the use of the Wheaton variable exhaust it is claimed that a thinner fire can be carried, coal is saved, flues last longer, and spark throwing is reduced.

The apparatus acts with the action of the reverse lever and the pressure of the exhaust in the stack is directly dependent upon the relative position of the reverse lever upon the quadrant. If the reverse lever is at the end of the quadrant the separate exhaust is at its greatest opening, and this opening is gradually reduced as the lever is hooked up to running position. At this point the valve is closed. In connection with this device Mr. Wheaton has invented a drifter which is used in connection with the separate exhaust, which, making a direct communication with both ends of the cylinders, similar to the ordinary bypass valves, and together with the variable exhaust appliance can be readily attached to any locomotive without changing any mechanism whatever.

Our illustration shows the device attached to one of the locomotives of the Chicago Great Western Railway, and from tests made under the supervision of Mr. John Birse, master mechanic, and Mr. John Lynch, traveling engineer, it has been demonstrated that with the Wheaton variable exhaust the engine maintained a higher rate of speed. The horse power with the variable exhaust valves closed averaged 340, while with the valves open the horse power was increased to 380, the general increase of efficiency was raised 12 per cent. These mark an important saving and we shall be surprised if the Wheaton variable exhaust does not come into more universal use.

Railway Gymnastics.

The Railway Times, the official organ of the railway men of India and Burma, has a happy method of describing railway collisions. This is a sample of its latest: "On the 2d, a collision took place between 6 down passenger and Pilot at Partabgarh, and from all accounts it appears that the pilot had an officiating D. T. O.'s carriage attached to 6 down, and, through the compact, gave an exhibition of its geometrical talents by throwing itself at an angle of 150 degrees obliquely, and Mr. Leech, who was in his carriage, was forced to display a series of wonderful gymnastic performances, by standing on his head and suddenly falling on his stomach, then doing a double somersault, and then standing serenely outside. He would not repeat the feat were he asked to do so by his friends."

This Indian narrative of the *Times* writer reminds us of a Scottish emigrant who was counting the stories of the Park Row building in this city and falling backwards he fell into a coal chute, and after recovering his breath philosophically remarked: "It's a grand thing I fell in here, for there's twa stories I wadna kent naething about if I hadna took this tumble."

We are surprised that so few express company's money orders reach us to pay for subscriptions and books. Express offices are convenient for most railroad men to reach, and the orders are as good as postal orders. People are foolish to send money in a letter if they can possibly obtain an express or post office order. The mail of RAILWAY AND LOCOMOTIVE ENGINEERING has unfortunately gained the reputation of being rich in money, and thieves at many points are taking advantage of this knowledge.

The astonishing record of putting a train of high class merchandise into Chicago six days per week on a sixty-hour schedule from New York, and have the train on time day after day, was begun three months ago by the B. & O. and continues with clock-like regularity.

The ginger jar of the management is large enough to afford intermediate cities equivalent despatch so that Baltimore, Washington, Pittsburgh, Wheeling, Columbus, Cleveland, Cincinnati, St. Louis, etc., share in the benefit, and New York shippers are correspondingly benefited and greatly elated in consequence.

Patent Office Department.

An improved railway signal torpedo has been patented by Frank Dutcher, Versailles, and Philip Peter, Pittsburg, Pa. It embraces a torpedo in a fibrous case, a rail-engaging strap and a band surrounding the flange.

Thomas Nimmo, of South Portland, Me., has patented a spark arrester for smokestacks. It comprises two parts of an adjustable box having perforations and means for bringing the two parts together with jarring force.

A brake shoe comprising a body cast in one piece, with a reinforcement of intertwisted strands of wrought metal embedded in the casting, has been patented by William P. Taylor, Buffalo, N. Y.

A lubricating device for journal boxes has been patented by David L. Gensbigler, Youngwood, Pa. It has the added mechanism of presenting an adjustable grinding and polishing roll to engage the journals.

An improved car replacer has been patented by Charles F. Heitzman, Brooklyn. It comprises an inside member having ribs to receive the tread of a car wheel while the opposite member is furnished with means for engaging the rail.

James C. Fritts, Newark, N. J., has invented and patented a device providing a removable guard for journal boxes. It comprises an open coiled spiral member and a longitudinal reinforcement for the same. Its object is to prevent the oil-soaked waste within the box from being compressed against the lower surface of the brass.

A draft apparatus to be applied to locomotive chimneys during the initial stages of firing has been patented by George Hughes, Bolton, Eng. It comprises a movable hood to enclose the chimney, a fan rotating in a chamber, an auxiliary chimney to carry away the smoke and a motor to drive the fan and attachments.

An ingenious device whereby the valves of a locomotive can be instantly changed from simple to compound operation has been patented by James B. Allfree, Indianapolis, Ind. It is adapted for use on any kind of four-cylindered locomotive using high and low pressure of steam.

An adjustable exhaust for locomotives has been patented by Charles H. Lewis and Jeremiah Smith, Washington, D. C. It provides a series of differently diametered nozzles adapted to align one at a time with the mouth of the exhaust pipe, and attachments whereby they are held and rotated into place as desired.

A crank shaft having the combination of two pairs of crank arms with a counterbalance composed of two sections of the adjacent members has been patented by Francis J. Cole and William S. Stotzoff, of Schenectady, N. Y. The combination forms a perfect counterbalance, the parts being at equal angles to the radial planes of the pair of crank arms in line axially with the shaft.

In relation to the burning of oil in locomotives Wellington S. Jenkins, Cleburne, Tex., has patented an atomizing burner comprising a hollow body having two chambers, one for liquid fuel, and the other for an atomizing fluid, and a burner nozzle to which the chambers lead through a thimble with annular grooves. The apparatus has a steam chamber with an opening near the nozzle.

Francis J. Cole and Henry B. Oatley, of Schenectady, have patented a steam boiler superheater. The combination embraces a superheating tube, a system of superheating tubes therein, which is exposed both inwardly and outwardly to the products of combustion passing through the superheating tube, with attachments to a steam supply pipe and to a steam delivery pipe. An illustration of this device appears in another page of this issue of RAILWAY AND LOCOMOTIVE ENGINEERING.

Remarkable Railroad Improvement.

The fact that 5,500 freight cars were ordered in one week by only three railroads gives an idea of what our country can do when it is let alone by rate disturbers, personal profit politicians and the like, says the *New York Sun*. Two thousand of these freight cars were ordered by the Burlington, besides 500 box cars. Fifteen hundred are freight cars for the Chicago and Northwestern, in addition to the 1,500 ordered by the same company in May. The other 1,500 are ventilated cars for the Atlantic Coast Line. It may be noted that in 1904 only thirteen roads, of an aggregate mileage of 524, were sold under foreclosure, while in 1896 no less than fifty-eight roads, of an aggregate mileage of 13,720, suffered that fate. This comparison is the more striking in view of the fact that 30,000 miles of new road have been added since 1896.

A movement is on foot to establish works in the City of Mexico for the building of locomotives and automobiles. Of course American train power is pushing the scheme. Parties prepared to form a company have applied for a concession authorizing the establishment of locomotive works at such point in the republic as may be selected. The immediate vicinity of the national capital is considered the most suitable location; and it is believed that the present boom in railway building throughout the country will induce the early beginning of work. Already car works have been established and will soon be in operation. The two concerns will require the services of a considerable number of skilled mechanics from the United States.

ENTERING A TUNNEL ON THE ST GOTHARD R. R. TRAIN BEING PULLED BY TWO TEN-WHEELED LOCOMOTIVES.

The collection of little "L" road locomotives clustered near the Harlem river in New York is dwindling to a mere handful. They are little better than scrap iron, but industrial concerns all over the world have been purchasing these relics of antiquity and at a low pressure of steam they may crawl around for some years to come.

The Kansas State Fair authorities are arranging to have two old locomotives come together in a real railway collision as an entertainment for the patrons. They will see more than they expect at an exhibition of this kind some day.

General Correspondence.

The Educational Value of a Systematic Reading of Good Mechanical Papers.

Editor:

The saying that not by companionship alone but by what one reads a man is known, is a true one, and all that is necessary to prove it is a few moments of conversation with a man who does not keep posted on what is going on in the world around him; should he be an engineer or mechanic and not reading the papers pertaining to his occupation you will find him one of the one man's experience kind who only knows what he has been able to learn by personal experience, and he will only add to his stock of knowledge in the same slow, limited way.

Experience may be a great teacher, but it is an expensive one, and in these days of so much good literature it is not necessary to have all the experience ourselves. Mechanical papers are the means through which men pursuing a mechanical vocation exchange their ideas and views upon certain subjects in their line, giving and receiving accounts of the successes and failures experienced by themselves and others and invariably profiting from the same. They teach him, and help him along with his own learning, and in these times of rapid changes along all lines, particularly in machine design and conditions under which the same is operated, the engineer or mechanic should devote a share of his time to keeping in touch with the new ideas and practices that are constantly coming into use.

Men who master their trades do not acquire their knowledge spontaneously but have to do so by years of head and hand work.

By systematic reading, I mean having a regular system and adhering to it; mine is to read a portion of each article so as to become familiar with that to which it applies, then at some future time, should I have use for any knowledge contained in these articles, I can readily find the same, as I always file away the papers that I practice this system with, and in time it is surprising how often you will be looking up articles that you thought at the time of your first reading would never interest you.

Good mechanical papers are those in which care is taken in the choosing of what should and what should not be published. We cannot afford to give our time in reading trash, yet the practical man should be allowed full freedom in the expression of his views and thoughts, for it is in the reading of these that we get such information as cannot be obtained in any other way. Standard works on engineering and mechanics are a necessity and every engineer or mechanic should have one or more to refer to; but the papers differ in that they get down to facts and details, giving the results under all conditions, for what might be a success under one condition might be a failure under another. They also keep us posted on all subjects pertaining to our business. Surely they have a mission to perform and they are doing it, and doing it well.

E. N. WIEST.

Manistee, Mich.

TRAIN CROSSING THE SCHUYLKILL RIVER AT PHILADELPHIA.

Water Circulation.

Editor:

In the report on Boiler Design, read at the 1904 Master Mechanics' convention, there was a good deal said about water circulation, and as the committee was continued, I have looked for more light on the subject, but I cannot find that anything was said about water circulation at the Manhattan Beach convention. I am sorry for this omission. A part of the report last year read:

"It is essential that the circulation within the boiler shall follow such lines and proceed with such regularity that solid water may overlie all portions of the heating surface.

"Such circulation is due to the excess of weight of a comparatively cool column of water over a hotter and lighter body or a mixture of hotter water and steam, the design of boiler which least impedes the flow due to this head will permit of the most rapid circulation, and hence most rapid carrying away of heat from sheets. . . .

"It would appear that for a given boiler there is a maximum allowable steam generation without injury to the sheets determined by a maximum possible circulation in that particular boiler."

That is all fine theorizing, but it is mostly hot air. I have seen dozens of patented devices applied to locomotive boilers for the purpose of promoting water circulation. The working of these things was generally demonstrated by means of a model glass boiler or by water glasses that showed the rapid movement of the water caused by the patented contraption. Some enterprising master mechanic would apply the full size apparatus to a boiler or two, the operation of the thing would be carefully watched for a week or two, and reports would come in saying that the circulation was saving 10 or 15 per cent. of the fuel. The patentee or promoter would go to other master mechanics with the glowing reports of saving, and some of them would apply it to more boilers, and so it would make a start into operation. But the inventor or the promoter could not remain all the time to keep the merits of the circulator in evidence, and its good qualities would be forgotten with the result that the device would find its way into the scrap heap when the engines went in for general repair.

There is a great deal of idle theorizing about water circulation that is not founded on experience. Our theorists tell us that when tubes become coated and the boiler gets loaded with mud, the resulting waste of heat is enormous. Yet you and I have seen engines shopped whose boilers were almost a solid mass of mud and scale, yet it affected the steaming very little, and when the engine came out with a clean boiler it burned just as much coal as it did when the boiler was loaded with solids.

We hear a great deal about the necessity for increasing the water spaces. It is all poppycock. You remember the Knott smoke consumer and water circulator that had brick walls set like gravestones? Well, that combination had vertical plates dividing the space in the water leg, the intention being to have the colder water move downwards in the space next to the outside sheet and the heated water mixed with steam ascend in the space next to the hot inside sheets. Some people were carried away by that combination and it was applied to many locomotives where the feed water was very hard. In practice it was found that all the water circulation was in the space next to the inside sheets and the outside space gradually filled up with mud and scale, because the water there was stagnant. But it did not seem to make any difference to the steaming qualities of the engines, and the circulating plates that were useless remained in place until new fire boxes were needed. There was little more than one inch of clear water space, but it was sufficient. Some of the older locomotive men on the Lake Shore could tell interesting things about that attempt to make the water circulate according to theory.

In making these comments I do not claim that liberal water space is not a good thing, but merely to make the point that a narrower space will pass the water through without damage to the sheets.

There are some things about mud rings and about size of cylinders and of steam ports that are worth considering from the standpoint of experience, but I shall leave them for a future letter.

I. B. Poor.

Honeybrook, Pa.

Low Water in the Boiler.

Editor:

I was very much interested and amused at the happy account of the Civil Service examination of the candidates for State inspector of locomotive boilers, in your August issue, but you will permit me to state that the question in reference to locating the height of water in the boiler when the water is below the lower gauge cock is really not so difficult a question as your able contributor seems to think it is. Instead of putting out the fire or, as your correspondent jocularly suggests, bringing along the X-ray expert to try his hand at looking through a sheet of steel, a better plan is to open the second gauge cock and then opening the lower one it can readily be seen if the steam from both is exactly similar; that is, if both show "blue steam," it is safe to assume that the water is at a dangerous depth below the lower gauge. If, however, the steam from the lower gauge cock is saturated with water, the experienced eye will be able to detect by the apparent degree of saturation the nearness of the water to the lower gauge cock. To tell the exact distance in fractions of an inch is a physical impossibility, but to make a close estimate by the appearance of the steam by the method pointed out is not only easy but is done oftener than many would care to admit. If the fire was put out every time the water is low there would be a great quenching of fires. I presume your able correspondent is aware that there is usually a considerable distance between the lower gauge cock and the crown sheet.

J. Grant.

Elizabethport, N. J.

Cultivating Political Pulls.

Editor:

Under the heading of "Candidate for Railroad Commissioner," a very pertinent paragraph appears in your issue for July, intimating that the candidate supported by several divisions of the Brotherhood of Locomotive Engineers lacked one qualification that would likely defeat the best efforts of his friends—he was not an accomplished wire-pulling politician.

Doubtless this pre-requisite is as essential in the State of New York as it is here in Pennsylvania, and will likely continue to be so just as long as the appointing powers are dependent upon party organization for nomination and election. Political pull, like preferment for place, does not come to a man over night. It has to be looked for and paid for either by long and valuable services to a distinct party organization, or in hard cash to a party leader.

District-Attorney Jerome, of your city, speaking in Kansas the other day, declared that United States Senatorships were publicly put up for sale. The practice of bargain and sale in political places is perhaps as open and scandalous in America to-day as it ever was, with this difference, that the public conscience has, if anything, become more hardened. As the poet Burns, in speaking of certain conditions in Scotland in his day, said:

"They're sae accustomed to the sight,
The view o' 't gies them little fright."

Indeed, the real fault begins with the people themselves. A candidate for the humblest elective office is looked upon as a proper subject for spoliation and robbery. His contribution to the campaign fund, or assessment as it is called, is part of the agreement, and is looked upon as a matter of course. Every idle vagabond, too lazy to work, assures the candidate that it is in his interest that he is abroad, and if he only had a little money to "treat the boys" he would land the candidate at the head at the polls.

Independent clubs, so-called, although very dependent financially, set a fixed price for so many votes, and in many instances the money is paid, but the goods fail to be delivered.

Thus it is that the successful candidate having passed through this ordeal of chicanery, or tariff, or whatever it may be called, is in a certain sense compelled to look for some return above and beyond his limited salary. A Senatorship is considered proper game for a member of Assembly. Thirty thousand dollars is said to be a low price paid by a Senatorial candidate. This is equal to his entire salary for six years at Washington. Hence it can readily be seen that commissionerships and other offices requiring Senatorial endorsement afford an opportunity to the Senator to recoup himself.

With this condition of things it is, therefore, apparent that mere ability to discharge the duties of the office is a secondary consideration. We often hear of office seekers failing to secure an appointment, but rarely hear of them failing to fill the position if they are fortunate enough to secure appointment. The mere getting together of a delegation to present one's claims to the appointing power is rarely of any benefit. The action of the appointing power is guided by those who are near to him, and members of Divisions of Locomotive Engineers are, generally speaking, as far away from Senators and Governors of States as they are from the Czar of Russia or the Mikado of Japan.

It is wiser to attempt to accomplish what is reasonable and within grasp than to go beyond the range of possibility, and if railroad men generally would take a warmer and closer interest in the body politic in their immediate vicinities, it would not only be better for the politics but it would be better for themselves. With some opportunities to observe the attitude and actions of railroad men during political campaigns as well as some personal experience, I must state that in the cases of the nominations I have observed that fell to the lot of railroad men, the candidates did not meet with that cordial support of their fellow workmen which they ought to have done.

It has been truly said that it is difficult to see that those who are near us are any greater than we are ourselves, and hence we are apt to be jealous of the success of those around us, but surely it would be exhibiting a wiser and a better spirit to help one of our own class to legislative office, hoping and believing that they who have shared our toils and hardships would, in all likelihood, know what was within the scope of legislative enactment likely to benefit us as a body, rather than to support some fledgling lawyer whose father may have been able to send a young blockhead a long time to school, or to send some other one to legislate for us who may have shown some ability in accumulating money by selling rum.

In any event, I will venture the statement that it is the experience of railroad men generally that in political campaigns they do not support each other with that degree of brotherly interest which their common interests might be expected to induce them to do, and it is not to be wondered at, therefore, when some sporadic occasion arises similar to the one so pointedly and pertinently referred to by you, that a candidate for some appointive office finds that he has not the necessary "pull" to "land." The appointing powers know the limited political value of the source from which his recommendations come, and they act accordingly.

Wm. Byars.

Scranton, Pa.

Broken Reach Rod and No Brake.

Editor:

I have been following up this question since June issue, 1905, of a runaway light engine down a grade, with no brake, and have come to the conclusion that with the modern engines of to-day it would be almost impossible to lift links by trying to fish up eccentric rods. If an engineer and fireman could slip a piece of rope around end of lifting arm, they could not get power enough to reverse engine. I also think it a very difficult task to drive a key out of valve rod, or break this rod connection when engine is running by blows from a hammer.

Allow me to suggest a way which I consider would be more reliable than the remedies mentioned in previous issues:

Start both injectors wide open and fill boiler with water, open cylinder cocks and then slightly open throttle and allow water to feed into cylinders, this making water pumps out of cylinders and will stop the motion of the engine. With cylinder cocks open and water relief valves in cylinder heads there will be no danger of knocking out head, then as speed of engine decreases increase supply of water by opening throttle, then close cylinder cocks, and engine will stop, and the necessary repairs can be made. Or if engine is wanted to be moved, open cylinder cocks and close throttle till cylinders are free of water; then slightly open throttle, when engine will move.

Yours truly,

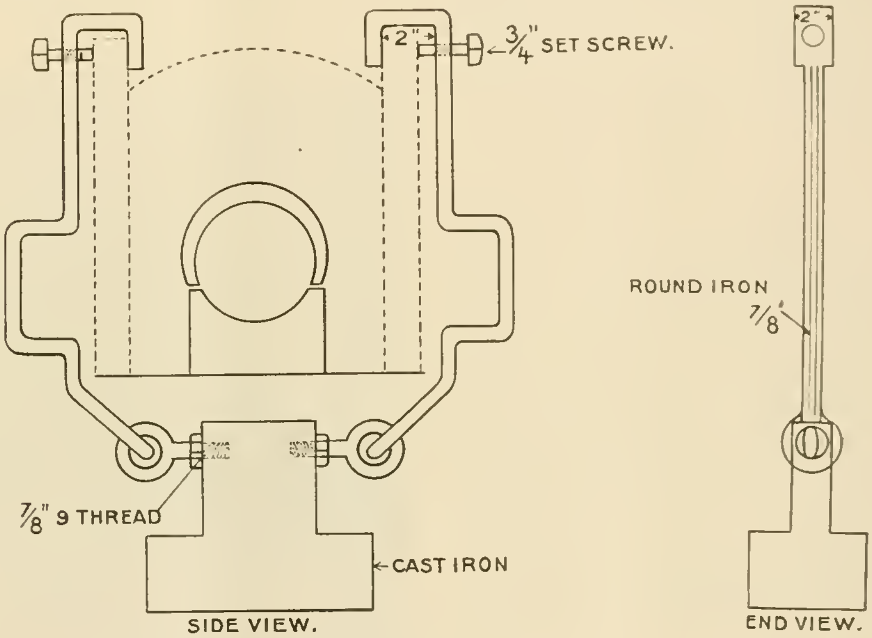
J. A. McCrea.

Kenora, Ont.

Driving-Box Holder.

Editor:

Enclosed is a sketch of an apparatus for holding driving boxes right side up on the journals after the cellars have been packed and put into place. In moving the wheels from place to place in the shop, the boxes sometimes get turned upside down and the pressure on the waste forces out the oil and the waste does not retain its original position if left upside down very long. This disturbance often causes heating of the boxes.



METZGER'S DRIVING-BOX HOLDER.

This apparatus should be put on as soon as the boxes are fitted and remain until the wheels are in the final position under the engine. For the sake of economy, old cast iron bulldozer dies are very good weights for medium sized boxes. The offsets in the center are for handles. The set-screw on top is to prevent the hooks from slipping off. Mr. Metzger, our pit foreman, is the originator of the apparatus. We have enough for ten engines here and they have been a success.

John W. Percy.

South Tacoma, Wash.

A Freak Boiler Water Circulator.

Editor:

On February 18, 1868, the Boston & Lowell R. R. had an engine named "Wm. Sturgis," blow up at Lowell, killing George Spaulding, engineer, and Stillman White, fireman, and Henry Smith, house foreman. At the inquest held at Lowell there appeared as expert witnesses one Norman Wiard, and another man named Hayes. Norman Wiard had an invention which he claimed would prevent any like occurrences. I was running at the time a Mason engine named "Nashua," 16x24 ins. 5 ft. wheels, on freight service. Mr. Wiard wanted very much to put his invention on the "Nashua." Mr. J. B. Winslow our then superintendent, was willing to let him put it on the "Nashua" if I would agree to run it. I told him that I thought an engine with plenty of water and a reasonable amount of steam was as safe as one with low water.

I was not favorably impressed with his invention, being "an old fogy," as Mr. Wiard expressed it. So they put his invention on a Hinckley engine, named "Rumford," 15x22 ins., doing spare work, and a Mason engine called "Merrimack," 16x24 ins., 5½ ft. wheels, running a passenger train. R. T. King ran the "Merrimack" and J. Harriman the "Rumford."

The invention was a system of pipes to take the water from the bottom of the boiler to the top just over the crown sheet and spray it over the tubes and crown sheet. It was put on the "Rumford" first. She ran something like two weeks, but bothered quite a little. Another was put on the "Merrimack." She ran a few trips between Boston and Nashua, when she, like the "Rumford," lost three of the top row of her flues. This was our experience with Wiard's boiler attachment.

Mr. Wiard had his invention patented, I think. He was also connected with the U. S. Government in getting up big guns for harbor defense, and made quite a number of experiments in Boston Harbor. He afterwards went to China to show the Chinamen what he knew about harbor defense. He got into trouble with the Chinamen and they put him in the stocks. He afterwards returned to this country, and I think he died in Washington.

Mr. Wiard's invention he claimed was to prevent burning flues, and avoiding boiler explosions, but, like others, it failed. I do not think he claimed anything for superheating steam. This is about all the information I can give you.

R. T. King, who was engineer of the "Merrimack," is still with us running. J. Harriman died in Texas some twenty years ago.

BOSTON & MAINE.

No Poor Coal.

Editor:

I have read with much amusement the remarks made by T. F. Adams, master mechanic of the St. Louis Southwestern Railroad, at the Master Mechanics' convention, wherein he says that there is not such a thing as poor coal and no coal that will clinker if it is properly fired. According to certain articles that appeared in RAILWAY AND LOCOMOTIVE ENGINEERING several years ago, the best proof of good firing is the absence of black smoke. If you make that the basis of judgment of the engine's running on the St. Louis & Southwestern, they are far from showing a good example. Firemen in this country do not sit up nights trying to think out how to keep her hot on smokeless firing, and the Southwestern engines are as smoky as any to be found in Arkansas. After I read the article about what Mr. Adams said, I made it my business to visit some of the ash pits on his road and I have seldom seen more clinkers for the quantity of ashes dumped.

My discoveries make me believe that Mr. Adams was putting up a joke upon his fellow members of the Master Mecanics' Association, but RAILWAY AND LOCOMOTIVE ENGINEERING has no right to circulate fun of that kind. Better return to your Ananias Department, which was quite as good as most of the stories we read about coal saving.

R. M. WILLIS.

Jonesboro, Ark.

The New Shops of the Lehigh Valley Railroad at Sayre, Pa.

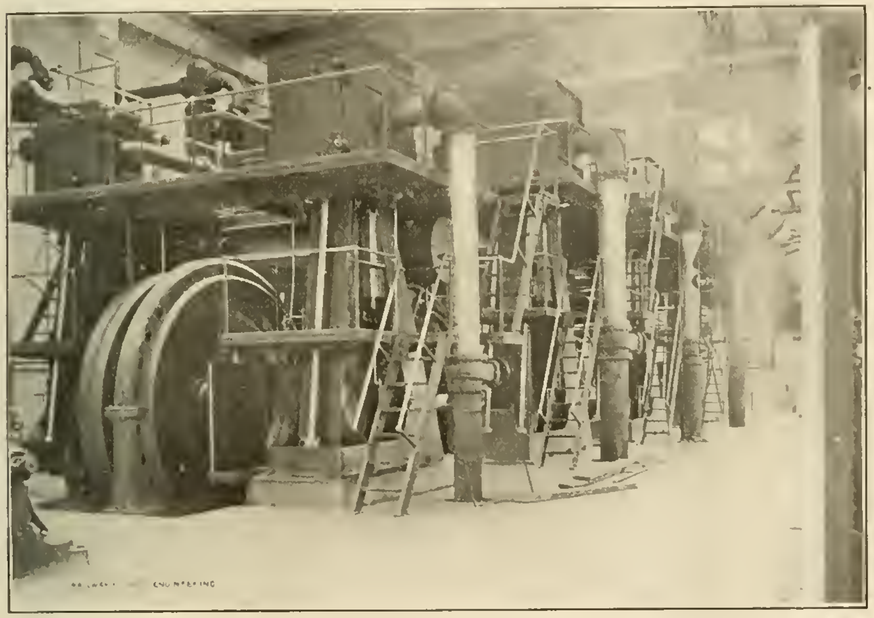
Those who have been at the Crystal Palace, London, or at the Centennial Exhibition at Philadelphia, may see a reproduction in the new shops of the Lehigh Valley Railroad at Sayre. The main building, which measures 750 ft. by 360 ft., is completed and the new machinery is being rapidly put in place. The structure, with the exception of the outer walls, which are of brick with granite facings, is of steel with steel and glass roof, the glass toward the north, the steel sheets toward the south. There are two 120-ton cranes and ten 15-ton cranes traversing the building. There is accommodation for 52 locomotives undergoing repairs, and when the machinery is all in working operation there will be about 400 machines, all of the newest and best type of their kind, ranging from 90 ft. planing machines and 9 ft. wheel lathes, to the smallest sized screw cutter. Shafting suspended from solid steel hangers stretches the entire length of the building, driven in 100 ft. sections by electric motors, many of the larger machines being driven by independent variable-feed motors. There are 96 small forges and 10 large forges in the blacksmithing section. We observed that the anvils were all of the Hay-Budden make, and highly spoken of by the skilled workmen.

The division of the shop into sections has all the mathematical exactness of an army division. The gang foremen, of which there are eight, had each six pits, and each was provided with an "office" of his own, where he is monarch of all he surveys. The general foreman has a central "office," elegantly equipped and connected by telephone with his assistants' "offices." The tool department is something new. There are 60 electrically equipped stations throughout the shop, to the nearest one of which the workman desiring a tool comes and writes on a pad and touches a button and goes about his business. A messenger from the tool room arrives and without loss of time the workman is supplied with the desired tools or material. The section foremen have a very superior air about them. Their chests seem to swell out in their immaculate shirt fronts. The general foremen have all the independent exterior of retired plumbers; but when you reach the kindly eye of Mr. E. T. James, the gentlemanly superintendent, you meet the kind of man it does one good to meet. There are no collars or cuffs about him, but all the multitudinous details of the marvelously mighty maze around you is at his finger ends. The RAILWAY AND LOCOMOTIVE ENGINEERING magazine seemed to be a magic word to him. He had read it in his youth. He kept on reading it in the busy days of his early manhood, and he was reading it still in spite of the thick-thronging avalanche of affairs incident to the upbuilding and running of such a vast mechanical maelstrom. If he knew more than those around him it was because he had read more.

MAIN REPAIR SHOP OF THE LEHIGH VALLEY RAILROAD AT SAYRE, PA.

We proceeded to the great power house and began at the beginning. Here were the 36,000 horse power engines, built by MacIntosh, Seymour & Co., Auburn, N. Y. Here were four 300 horse power dynamos made by the Westinghouse Company. Beyond these was the far-reaching row of white furnaces with automatic stokers in full operation, the product of the McClaye, Brooks Co., of Scranton. The power house resembled the interior of some monster Atlantic liner multiplied by three. Then underneath the great engines there were the thousand and one contrivances used in the distribution of the titanic forces, the steam and electric conduits, the water and compressed air pipes, the myriads of dials and gauges and expansion joints and controllers and circuit breakers until we seemed lost in our wanderings "into the underland, into the wonderland."

Into each of the locomotive pits there are valves for steam and compressed air and water. The concreted bottoms of the pits slope slightly to one side. There is no central cavity for accumulated water. The smoke funnels over the blacksmiths' fires turn suddenly down into the ground. We shook our head at the unnatural innovation, but Mr. James advised us to feel the suction draft inside. We ventured rashly near one of the funnels and a copy of the *Tunkhannock Express* flew out of our feeble fingers with the rapidity of chain lightning and went into utter darkness. These suction drafts were admirably suited for firing up a locomotive in the shop, an adjustable funnel being placed over the smoke stack and no blinding smoke allowed to affect the general inspection of the engine being tested.



36,000 HORSE POWER ENGINES AT THE LEHIGH VALLEY RAILROAD SHOPS AT SAYRE, PA.

Mr. James has introduced many valuable improvements of his own. Under the larger lathes he has prepared capacious pits where the steel shavings find themselves spinning their endless coils far away from the feet of the busy workmen. A laborer comes along at proper intervals, and the accumulated cuttings are removed at an adjustable opening in the floor.

Space, or rather the want of space, forbids us dwelling on the far-reaching store room, the finely equipped oil room, the great heating and ventilating apparatus, the extensive lavatories, all arranged on a scale of magnitude compatible with the great central building. A 70-ft. turning-table, moved by electricity, was conveniently near. Everything and everybody seemed well provided for except Mr. James himself. He had the remains of the last of 40 old houses that were pulled down to make way for a part of the works, and into the first floor of this rickety establishment he had his headquarters. He had thought of all but himself. Like Alexander, who was said to have given everything he had away except his sword, Mr. James looked to be the only poorly accommodated man in the place; but he is naturally and easily the master mind in a vast and perfectly equipped establishment worthy of a great railway and of the mechanical ingenuity of the twentieth century.

A Striking Comparison.

An old inventory of the Mohawk & Hudson Railroad, dated January 1, 1833, says the *Four Track News*, gives the following as the total rolling stock of the road at the time:

Three locomotives (the "John Bull," the "De Witt Clinton" and "The Experiment"); three carriages, accommodating twelve passengers each, nine accommodating nine each, two accommodating six each, and three accommodating eighteen each, a total capacity of 183. In contrast with this, it is interesting to quote a few figures of to-day: The present equipment of the New York Central and Hudson River Railroad, of which the Mohawk and Hudson is a part, includes 1,851 locomotives (with seventy-six in process of construction), and 1,177 passenger cars with a capacity of 70,962 passengers. These figures do not include officer's, pay or baggage cars. In addition to these surprising figures there are 277 Pullmans in daily service on the New York Central.

Firefly vs. Electric Light.

Concluding a course of lectures at the Royal Institution on "Flame," says the *London Standard*, Sir James Dewar exhibited a tabular statement showing the small amount of light, compared with the energy expended, which the best of human appliances yield, and how utterly man is beaten by the firefly. The figures stand somewhat as follows:

	Percentage of light.	Non-luminous energy.
Candle	2	98
Oil	2	98
Coal gas	2	98
Incandescent lamp	3	97
Arc lamp	10	90
Magnesium lamp	15	85
Cuban firefly	99	1

In the economy of light the little phosphorescent beetle of the Eastern or Western archipelagos is easily first. If we could produce light as efficiently, either by gas or electricity, millions and millions of tons of coal would be saved yearly in the world.

There is, it seems, a great deal more than carbon in black coal smoke. Prof. E. Knecht has analyzed the soot from Manchester coal smoke, and at a recent lecture he exhibited the results of his analysis. Among them were snow-white samples of ammonium chloride, ammonium sulphate, calcium sulphate, and a beautifully crystallized paraffin hydrocarbon similar in properties and composition to a substance present in beeswax. The soot also contained 13 per cent. of heavy hydrocarbon oils. From some of the products Professor Knecht had prepared a brown dyestuff which produced absolutely fast shades on cotton.

One million dollars is to be spent by the New York, New Haven & Hartford Railroad Company on Norwood, Mass., and 500 artisans are to be transferred from the shops of the company in the Elm City to Norwood. The company now maintains a number of small shops, which are scattered here and there along its various divisions, and, in some instances, inconveniently located as to the centers of traffic. They are generally equipped with machinery of an old pattern, which adds to the cost of making repairs. The Norwood shops will be made a thoroughly modern repair plant with first-class tools and general equipment.

The loss of life caused by railroad accidents in the United States is deplorable, but a greater number of people lose their lives every year by falling out of windows.

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William Mooney.

An open switch on the bridge at Newark Bay, a locomotive with a heavy train of passenger cars approaching, the keen eye and clear head of the engineer taking in the situation at a glance, he calls to the fireman to jump for his life, his strong hands grasp the levers, the great engine rocks and heaves as the ponderous wheels splinter the crumbling ties, the brakes are shrieking, the train of cars is slackening its speed, the passengers are saved, the fireman is saved, and the engine falls over into the deep waters, and William Mooney, the engineer, passes alone through the dark gates of death.

This is heroism of the highest and noblest kind. There is no thought of self in those last awful moments. There is the simple sense of duty. There is the heart of steel and the soul of fire. Men have died in battle and in storm and in pestilence-stricken cities ministering to the afflicted, but no man ever died more heroically than this man of iron. The tears that fall for such a man are blessed tears. They brighten our mental view, and humanity seems of nobler mould because of the vision of this high heroic soul.

Car Wheels.

The use of cast iron car wheels was the subject of a lengthy discussion at the recent convention of the American Society of Testing Materials, and copies of proposed standard specifications for cast iron car wheels have been sent to the members for a letter ballot. It embraces the usual tests which, with less elaborate details, have been in use for many years, and, in a certain sense, have served their purpose.

It is to be regretted that the members of the society have not seen fit to recommend the disuse of cast iron car wheels altogether. Experience has shown that with the increased weight of both passenger and freight equipment the mileage capacity of cast iron car wheels has been greatly reduced, with the consequent increase of breakage and accident expense. The need of the best material for car wheels is plainly apparent. The weight of cars and their loads have increased over 100 per cent. in recent years. It is impossible to increase the strength of the wheels in a like proportion, and even if it were within the range of possibility it does not follow that the apparent weaknesses in the brittleness of the flange, the utter inability to resist the effect of the increased tension of the brake shoes, with the consequent larger tendency to heating by such intenser action with the consequent softening of spots on the rim of the wheels, can in any proper degree be combated or overcome.

With greater weight of load the tendency to shelling in cast iron wheels, with the inevitable accumulation of abrasions, increases, not to speak of the rapid lessening of the cohesive quality in the metal, as may be witnessed by the rapid disintegration or crumbling of the angular portions of the wheels used in heavy traffic. In this regard it may be stated that in experiments recently conducted by the Institute of Engineers in London, England, it was demonstrated that the repeated heating of a piece of cast iron increased its size almost beyond belief, and that as the metal increased in bulk it lost in cohesiveness. This is owing to the large quantity of graphite which enters into the composition of the metal and which, seemingly, expands as it disintegrates. The repeated recasting of cast iron wheels does not improve their quality, and even after being subjected to the severest chilling process it is remarkable in what a short period of service the blemishes on the rims of the wheels begin to appear.

The tests proposed by the American Society of striking a series of blows on the rims or bodies of cast iron wheels is not the kind of test calculated to demonstrate the fitness of the wheel for the heavy service now necessary. The best test is the thermal test, which consists of pouring a circular band of molten iron 1½ ins. thick by 4 ins. deep around the tread of the wheel. If a wheel does not crack with this test, there is some likelihood of its being capable of rendering a reasonable amount of service. The effect on the best rolled steel wheels is scarcely noticeable except in the slight expansion of the rim.

As to the important element of cost, it might be stated that the comparison per 10,000 miles run of solid rolled steel wheels and chilled cast iron wheels is about $1.43 for steel as against $1.78 for cast iron, so that the larger first cost of the rolled steel wheel is soon minimized by the superior element of durability and effective service as compared with the use of the cast iron wheel.

It may be added in a general way that in regard to "fatigue" or change of state in all metals, it is well known that the frequent application of a load well below that producing stress up to the elastic limit eventually produces "fatigue" even in steel, and with much greater rapidity in cast iron. Reversals of the load accelerate this action. All metals when in a state of fusion assume a stringy, elastic form. Rolling and hammering of metals, while heated, induce the molecules to assume this form, but no sooner is the metal cooled than it begins to change slowly but surely from the fibrous to the crystalline form. The vibrations incident to all service, especially on railways, tend to accelerate the crystallization of metals. The defective cohesive force of cast iron which is about one-fifth that of rolled steel, renders the use of cast iron in wheels as wholly inadequate to the increasing requirements of modern railway traffic.

These facts are generally known, and are being acted upon by many who have carefully considered the subject, with the result that there is a constantly increasing demand for the most durable materials in railroad construction and rolling stock. It is to the credit of the locomotive builders that they have vied with each other in an earnest desire for the best materials for locomotive construction, and much of their splendid success is owing to this laudable desire, and we are hopeful of seeing this same spirit manifesting itself in a larger degree in the case of the makers of car wheels.

Result of Russia's Industrial Ambition.

The history of Russia during the last ten years appears to prove true the poet's word that "God moves in a mysterious way, His wonders to perform." About twenty years ago a movement arose to convert Russia, an essentially agricultural country, into an industrial nation, and all the wealth resources drawn from the soil of the vast empire were devoted to the inauguration of manufacturing enterprises. Here is the introduction to notes penned in Russia by the writer in 1898:

"For the last five or six years we have been hearing so much about the stupendous revival or advance of mechanical progress in Russia, that I was ambitious to observe on the ground the details of a movement which seemed unique in the development of the industrial arts. My studies of industrial progress in other countries had led me to believe that artisan skill had kept pace with the growth of education and intellectual force, and the accounts that had reached me of the spread of education in Russia did not justify the belief that the country had reached a positon to compete with other nations in the production of articles which called for mechanical skill and constructive intelligence. After several unsuccessful attempts to get into the heart of Russia, so that I could judge for myself c the real condition of the industrial boom that Americans have been raving about, I found the way open this summer, and made the best of my opportunity for observation."

* * * * * * *

"Russia is supposed to be an absolute despotism, ruled by the Czar, but in reality it is ruled by a crowd of permanent officials, mostly military. These officials are enamored on forms. Red tape practices never reached maturity until they found an abiding place in Russia.

"The formalities that must be gone through before a man can be taken on in an establishment like the Sormovo Works give a good illustration of red tape methods. When a man applies for employment, he has to bring his passport to show what place and class he belongs to. There are about ten classes above that of mujik, which is really the foundation of all the Russian people. If the foreman wants the applicant, he certifies what kind of work the applicant will be employed upon and the rate of pay. The passport is then sent to the public office for substantiation. If all particulars are correct, the passport comes back, and the man is authorized to go to a doctor for physical examination. If he goes through that ordeal satisfactorily, the passport is sent to the manager of the works, and if he countersigns it the foreman is at liberty to employ the man.

"It goes without saying, that an inelastic system of this character paralyzes business when foremen are pushed with work and are suffering for want of workmen."

The notes then proceed to tell of the efforts making in St. Petersburg and other Russian cities to create industries by the order of the bureaucracy which rules the country, and the stupendous task of converting illiterate mujiks, drawn from farms and rural villages, into workmen in engine building and ship building establishments. The Sormovo Locomotive Building Works, near Nijni Novgorod, on the Volga river, were described, and observations made about certain practices followed by the peasant mechanics. To quote:

"The works appear to be operated as well as circumstances will permit, but the circumstances are very unsatisfactory, from an American standpoint. As we passed through a court in the main works, a group of workmen were sitting on the grass smoking and talking. We asked Dixon (American manager) if he considered such practices permissible. He shrugged his shoulders and remarked: 'It would not be if I could help it, but an attempt to stop it would result in all the men walking out.' Although these men had only been a short time away from the plow and manure fork, they were learning the power of united action.

"In the rise of human beings from a savage condition to high civilization, certain stages have been passed by every race of people, no matter what part of the earth may have witnessed their labors for life, liberty and happiness, or what was more common, their endless struggle to enjoy a part of the earth's bounty and their own industry in peace and quietness.

"From savages, people rose to be hunters, then shepherds or nomadic pasturers of flocks, then agriculturists which led the way to traders and town builders. In nearly all civilized regions there was easy transition from the tilling of land to engaging in industrial pursuits, but in some parts, Russia being one of them, agriculturalists became wedded to the soil, and to-day the great mass of the Russian people are wedded to farm work, living in small communities in which they are permitted to manage their own affairs so long as they do not display political aspirations, and the heavy taxes are regularly paid. They are kept in dire ignorance, schools being practically unknown in the rural districts, ignorance helping to keep them loyal subjects of the Czar, the head of their church, whom they are taught to reverence as a demi-god.

"Until the industrial rage seized the rulers of Russia, there was no difficulty in keeping the mujiks in meek subjection; but when they were called away from their villages to work in factories and to lead the life of cities, new ideas concerning the rights of man were rapidly acquired. The princes, grand dukes and military officers, who are the real rulers of Russia, did not consider the educating of the peasants as a proper part of the transposition from land tillers to factory workers, so they were permitted to remain illiterate, the kind of person who makes the best material for demagogues to work upon. With this condition of affairs, it is not surprising that a large part of the peasant workmen are in a condition of blind revolt against the established condition that makes them mere animated machines.

"When the Russian Bureaucracy decided that they would build their own locomotives, make their own rails, engage in ship building and in the production of all sorts of manufactured goods, they brought forces into activity that will eventually finish their reign. When workmen join together in discussing and ventilating their grievances, leaders spring up who are the apostles in the demand for justice. As a rule these chosen leaders are the ablest men of their class. The rulers of free countries find some means of pacifying these men and very often they are promoted away from the ranks they have led too well. That, however, is not the Russian way. The rulers, made mad by workmen claiming rights, have ordered that all the ringleaders shall be sent back to their villages to resume their original hoe. It is like sending trained wolves into peaceful sheepfolds."

These men, accustomed to the comforts of factories, an association with kindred spirits, will not accept the change meekly, and their tongues will make short work of the mujiks' reverence for the Little Father, as they have been taught to call the Czar, and the parish priest will soon find his influence gone.

Verily Russian autocracy is in a bad way and Freedom's cause is awakening. The Bureaucracy and their chief, the Czar, have chained the Russian peasant to a life of hopeless drudgery where the earnings of his toil goes to support the tyrants in idle, profligate luxury, but these forces of evil could not have retained their long hold had they not been aided by the servile teaching of the Greek Church. The most serious phase of the new conditions in Russia is that the Mujiks have made some progress in doubting. They have old associates jeering at the teaching that blind obedience to rulers is the only way to salvation.

The revolt in the Russian fleet will be suppressed by the strong hand, but the "blood of the martyrs is the seed of the church," and has always been the foundation of liberty.

The Long Island Railroad Company have just completed a portion of their new electric system which will extend over 150 miles in Kings and Queens counties. The big power house at Long Island City is pronounced to be the best equipped power house in the world. The branch between New York City and Rockaway Beach is in full operation.

Drought and Bad Water.

Not often is presented the peculiar phenomena of an eastern railroad hauling water in tank cars for the use of its locomotives on account of failure of the usual source of water supply, yet this is the present condition of the Philadelphia & Reading Railroad. Its usual bounteous water supply, afforded by the Schuylkill river and its numerous tributaries, has become inadequate and is caused by the continual drought in the section traversed by the Reading lines. This is the first occurrence of these conditions in this territory. Probably similar droughts have occurred in the past in this section, but were not so severely felt as now. This indicates an increased growth of traffic and the consequent increased number of locomotives in service, rather than an unusual drought, and the phenomena may be regarded as an indication of prosperity and extended trade operation of the Reading lines. The trade and operating statistics incidentally present an improvement unsurpassed in the growth of traffic on this line, and probably is beyond similar increase on other lines in the eastern country.

In the West, where water supply is very limited, and in many cases wholly dependent upon artesian wells and small surface streams, alkali and other foaming ingredients are found in the water supply, making the handling of water in a locomotive exceedingly delicate, and the carrying of feed water a skillful operation on the part of the locomotive engineer. To handle a foaming boiler of feed water, without losing time and without danger to the crownsheet of the locomotive, is an attainment to which the western engineer comes naturally. Possibly the Reading drought will cause the same skill to be practiced by engineers unaccustomed to such necessities and will acquaint them with one of the trials with which the western engineer must accustom himself. In the meantime it will be interesting to know in this connection the damage from this source. If none occurs, it will certainly reflect great credit on the efficiency, and adaptability to new conditions, on the part of the eastern engineers.

Want the Mechanical Conventions in Denver.

At the Railway Mechanical conventions, held at Manhattan Beach in June, there was an influential delegation of business men from Denver, headed by Mr. Henry Schlocks, the well-known master mechanic, who worked to have next conventions meet at Denver. They were on hand too early, as the decision of where the next conventions will be held lies with the joint committee, which generally meets in December.

The gentlemen from Denver intimated that the citizens of the Rocky Mountain Metropolis were prepared to give the railway mechanical men a royal welcome. It is rather a long journey from the Empire State to Denver, but we are sure it would be worth taking for most of the people who attend these conventions, and it would be nothing less than fair to give western members the privilege of meeting in their own territory.

The Chancetaker Again.

A press dispatch from Buffalo, not long ago, gave details of how an engine on one of our leading trunk lines dropped through an open swing bridge into the City Ship Canal near the Tift Farm. The crew were all more or less injured by the fall. The conductor, it is said, stated that the bridge signal was set against them and the engineer asserted that he was unable to see it, owing to the glare of an electric light which stood near the signal.

The presumption is that the engineer knew the road or he would not have been in charge of an engine in that locality. The company had the bridge approach signalled. If the engineer could not see the signal as he passed it was his duty to have stopped and to have made sure of the indication. Going on and eventually falling into the canal, under the circumstances, looks like the work of a first-class chancetaker.

Irresponsible Advertising Agencies.

There have been great improvements of late years in the way that business concerns trying for railroad business manage their advertising department, but there is still for bettering of methods. Not a few firms will not be bothered attending to details, and they prefer placing their advertisements through concerns that make placing advertisements their regular business. When firms doing this work are reliable there is no fault to be found with their methods, but there are always some impecunious men who cannot make an easy living in any other way that are constantly ready to establish advertising agencies, and it is surprising how many of them succeed in making connections to represent legitimate concerns. Very frequently the connection lasts only long enough for the agents to waste the payments they have received from their customers without paying the bills of the advertisers. Then the latter come upon the principals for payment of their bills, and settlement has to be made the second time.

Book Reviews.

Hints on Painting Structural Steel. By Houston Lowe. Published by the Lowe Brothers Company, Dayton, Ohio. 45 pages, 16mo. Price, 50 cents.

That a fourth edition of this handy volume has been called for is the best proof that it has merit of a kind that appeals to the practical painter and paint maker. That paint making has become an exact science is generally recognized, and this little work presents all the essentials the practice of which go to produce the best results. The painting of structural steel is a matter of comparatively recent practice, and painters not familiar with the best methods cannot do better than to procure a copy of this able work. The book is on sale at the D. Van Nostrand Company's publishing house, 23 and 27 Murray street, New York.

Basis of Railway Rates. By Marshall M. Kirkman. The World Railway Publishing Company, Chicago. 250 pages, 16mo. Price, $2.50.

This is a new edition of a most important work discussing the great question of private vs. governmental management of railroads. The volume treats fully the subject in all its various bearings. It explains the economic and basic theory of railway rates and the natural laws that govern them, of the legal status of railways, the basis of tariffs, the influences that determine the charges of carriers, the nature and extent of competition, besides the peculiarities of governmental supervision and a host of other subjects relative to railway traffic. The book is one of the famous "Science of Railways" series by the same author, and ought to be in the hands of every man actively interested in railway transportation and management.

The Transactions of the American Institute of Electrical Engineers (Vol. XXIII) has just been published, and is a bulky octavo of 860 pages. It contains many valuable papers by prominent electricians, which, with copious notes and illustrations, render it a work of much value to all engaged in electrical engineering. Among the chief contributors are Walter I. Slichter, C. P. Steinmitz, W. A. Blanck, H. J. Ryan, E. W. Rice, L. B. Stillwell, W. S. Moody, D. B. Rushmore and many others.

The admirable address delivered by the president, Bion J. Arnold, at St. Louis, September 14, 1904, appears in full, and presents a singularly lucid view of the improvement made in electric appliances and transmission since the previous meeting of the Institute.

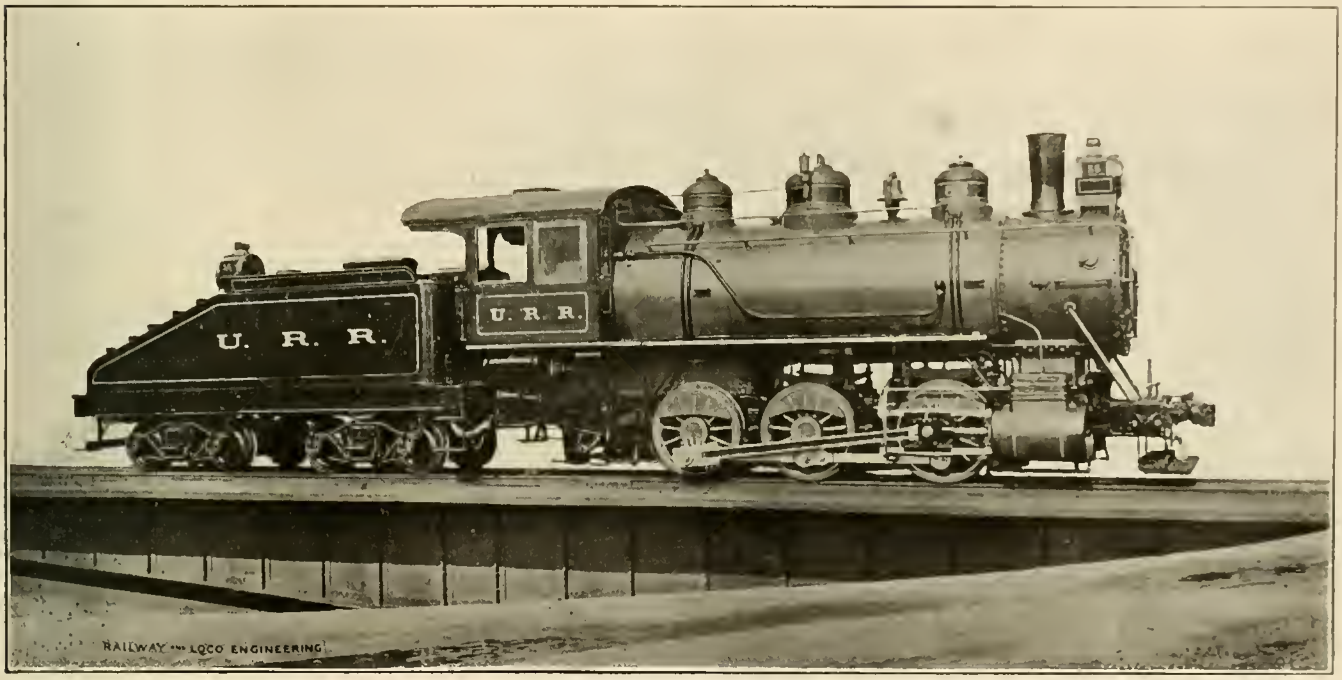
Cultivate the habit of detecting the possibilities for good in things and people; also the habit of letting people know how much you like them; it makes the world a pleasanter place.

Carnegie Steel Company Switching Engine.

We reproduce an illustration from an excellent photograph of a new switching engine built at the Baldwin Locomotive Works, Philadelphia, for the Carnegie Steel Company. The engine is of the six-wheeled variety, with cylinders 22 ins. diameter by 26 ins. in length. The slide valves are of the balanced type. The boiler is of 13/16 in. steel, of the straight type, calculated for a working pressure of 200 lbs. The fire box is also of steel, 114 ins. in length by 42 ins. in width, the depth at the back being 68⅛ and 70¼ ins. in front. The tubes are of iron, No. 12 wire gauge. The flues number 332, and are 11 feet in length. The total heating surface is 2,072 ft.

The diameter of the driving wheels is 51 ins., the wheel base being 11 ft. The length of the engine and tender is 41 ft. 11 ins., and the weight on the driving wheels 145,120 lbs., which is the total weight of the engine, the tank adding about 91,000 lbs. in a total weight of engine and tender of 236,000 lbs.

The capacity of the tank is 4,500 gallons. These engines, on account of the small diameter of their driving wheels, are of great tractive power; the above dimensions at a working pressure of 200 lbs. give a tractive power of 41,900 lbs.



CARNEGIE STEEL COMPANY SWITCHING ENGINE.

Oil-Burning Locomotives.

Experiments which have been made on the Frisco railroad system at Kansas City have successfully demonstrated that oil-burning locomotives can be run cheaper than coal burners. Mr. George A. Hancock, superintendent of motive power, under whose supervision the experiments have been carried on, reports that the oil may be used at a saving of $1.69 per day for each engine so equipped. This saving includes only the cost of the fuel and does not take into account the saving in labor resulting from their being no fires to build or fire boxes to clean. The crude oil is used just as it comes from the wells.

The apparatus used in conveying the oil to the fire box is simple and inexpensive. In the coal tender is an iron tank with a capacity of 900 gallons of oil. This will run the engine continuously about forty-eight hours. The oil passes through a pipe underneath the fire box, the flow being regulated by a lever within reach of the engineer. Before being ejected into the fire box the oil is subjected to a heating process which makes it highly inflammable. Just beneath the slot where it enters the fire box is a steam jet upon which the oil drops and is converted into a vapor that burns fiercely. The heat attained is said to be greater than is possible with coal as fuel.

Thirty switch engines of the Frisco system are being converted into oil burners as fast as possible. A storage tank with a capacity of 150,000 gallons is nearly completed and stands on a bluff east of the Frisco roundhouse. The Standard Oil Company will pipe oil to this tank and other pipes leading from it will convey the oil to small tanks convenient to the locomotives.

The experiments have been the object of much attention among railroad experts in the neighborhood of Kansas City. The use of oil in locomotives is by no means new. In Texas and Southern California nearly all locomotives use oil for fuel. In sections of the country where coal is scarce the oil burner is common. The increased price of coal may cause a larger use of oil as fuel for locomotives.

Report of the Interstate Commerce Commission.

From the statistics of railways in the United States for the year ending June 30, 1904, and which has just been published by the central bureau at Washington, we learn that the total single-track railway mileage in the United States was 213,904 miles, having increased 5,027 miles during that year. This increase exceeds that of any previous year since 1890. The aggregate length of railways, including tracks of all kinds, was 297,-073 miles.

On June 30, 1904, there were in service of the railways 46,743 locomotives, the increase being 2,872. As classified, these locomotives were: Passenger, 11,252; freight, 27,029; switching, 7,610. There were also 852 not assigned to any class.

The total number of cars of all classes was 1,798,561, this total having increased 45,172 during the year. The assignment of this rolling stock was, to the passenger service, 39,752 cars; to the freight service, 1,692,194 cars; the remaining 66,-615 cars being those employed directly by the railways in their own service.

The number of persons on the pay rolls of the railways in the United States as returned for June 30, 1904, was 1,296,-121, or 611 per 100 miles of line. These figures, when compared with corresponding ones for the year 1903, show a decrease of 16,416 in the number of employees, or 28 per 100 miles of line. The classification of employees includes enginemen, 52,451; firemen, 55,004; conductors, 39,645; and other trainmen, 106,734. There were 46,262 switch tenders, crossing tenders and watchmen. With regard to the four general divisions of railway employment, it appears that general administration required the services of 48,746 employees; maintenance of way and structures, 415,721 employees; maintenance of equipment, 261,819 employees, and conducting transportation, 566,798 employees. This statement disregards a few employees of which no assignment was made.

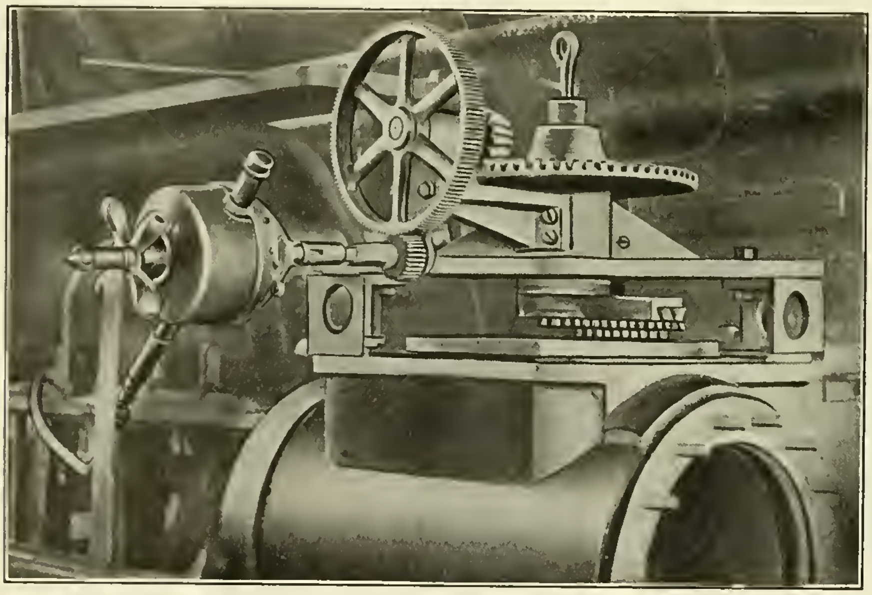
The number of passengers reported as carried by the railways in the year ending June 30, 1904, was 715,419,682, indicating an increase of 20,528,147 as compared with the year ending June 30, 1903. The passenger-mileage, or the number of passengers carried 1 mile, was 21,923,213,536, having increased 1,007,449,655.

The number of tons of freight reported as carried (including freight received from connecting roads and other carriers) was 1,309,899,165, which exceeds the tonnage of the previous year by 5,504,842 tons. The ton-mileage, or the number of tons carried 1 mile, was 174,522,089,577, the increase being 1,300,810,584. The number of tons carried 1 mile per mile of line was 829,476, which figures indicate a decrease in the density or freight traffic of 25,966 ton-miles per mile of line.

One must take the world as one finds it, and nobody in his senses expects to find a foretaste of heaven.—*W. E. Norris.*

Valve Seat Facing Machine.

Mr. D. O. Smith, of Jackson, Ala., has constructed a machine for facing valve seats which has several admirable features. As will be seen from the accompanying illustration, the machine is of the revolving kind. It is easily set over a valve face, and is furnished with ten cutters set in line. The cutters are one inch apart. When the tools are lowered to the cutting point and the machine set in motion the feeder gradually moves the row of tools in the required direction and after traveling one inch the job is finished. The operation can be completed in four or five minutes, and as the adjustment of the machine is on a perfect plane with the planed upper faces of the cylinder, the finished face of the valve seat is necessarily perfectly true. The tools are easily set to a straight edge and it will be readily observed that the work of facing the valve seat is completed when a tool has reached the place where the adjoining tool had begun.



VALVE SEAT FACING MACHINE.

Steam and Electric Power.

In contrasting railway traffic by steam or electric power the subject resolves itself largely into a matter of public convenience. There is little question that it is more pleasant to ride in an electric train with no smoke and no odor. On the other hand, the steam train has the advantage of each train having its own motive power, and being more of a self-contained equipment.

On electric lines, if anything happens to the power house or overhead lines, every train on that section of the road is at a standstill until the damage is repaired, and if it is line trouble and far out considerable time is lost in reaching the location of the trouble, especially if there is no steam locomotive at hand. One of the peculiar adaptations of modern engineering is the method of having portions of a road operated exclusively by electricity, while other parts are operated by steam locomotives.

In one particular line of this sort with 20,000 volts alternating current stepped down through transformers and the rotary converters to 550 volts direct current, the road was operated for the first six months by steam, both for freight and passenger trains. Then, having completed the installation of electric machinery and the necessary overhead work, the road was operated entirely by electricity. The electric service was continued for about eight months, using in the freight service an electric locomotive of 120 h.p. This locomotive would handle five carloads over the heaviest grades, but it was soon found in operating a freight line that it would not do to take a part of the goods and let the rest wait until it was gone back for; all had to go at the same time. A larger locomotive meant increasing the capacity of the power station and overhead lines. After studying the matter carefully, it was decided on this particular road to return to the use of the steam locomotive for the freight business, except for switching at points where the use of a steam locomotive was not practical.

In winter work it is found that the electric locomotive with the same power behind it will do as much work as steam, but when it comes to lightning and sleet, the steam locomotives have a decided advantage. For switching purposes it is often possible to use an electric locomotive where it would be impossible to use steam. In the matter of fuel the coal consumption is much less with the steam locomotive.

For several years the Reading Railway Company has been taking a number of young men as firemen's apprentices at the Reading shops. They are paid 10 cents an hour, and are taught all about the different parts of a locomotive. This course lasts a year, when the young men are put out on the road at firing. The present management of the Reading shops do not approve of that plan for training young men to be firemen and are about to abandon it.

A spectacular railroad wreck occurred in Pasadena, Cal. Dirt piled on the track by careless workmen caused a passenger train to leave the track in the heart of the city, and after running a short distance the engine struck a telegraph pole and fell over. George Luce, the engineer, had his left foot crushed. Thousands of people gathered around the wreck.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. When a student wishes to receive a private answer, he is reminded that it is usual to send a stamped envelope for the return letter. We will be glad to answer any question relating to railway matters, but prefer that they be suitable for our question and answer department. All letters intended for Our Correspondence School ought to be addressed to Department E.

The success of our Correspondence School Department becomes more and more assured as time goes by, and is evidenced by the many letters of appreciation which we receive. This is encouraging to us, as it indicates that our endeavors to give desired information and to guide the investigation of our readers and correspondents are properly directed. This is done with a view of obtaining practical information for our readers, making them better posted and more valuable men to their company and to themselves.

We encourage a free and candid discussion on all matters sent to us by our correspondents, and shall continue to look carefully after the interests of our correspondents and readers.

While we always stand ready and willing to answer a correspondent by private mail, still we must establish a limit to this, as such work has physical limits, and we are therefore obliged to direct as much as possible to the correspondence school columns, rather than answer it by private mail. This not only lessens the very considerable work of this branch of our work, but it extends the information contained in the questions and answers requested to all the readers who peruse the Correspondence School Columns, thereby permitting a manifold profit instead of profit to one individual.

We would further ask, in order to avoid repetition, that correspondents keep closely in touch with the monthly issues, thereby avoiding the unnecessary work of repetition.

While we shall not hold each correspondent to his bona fide signature and name, but will permit the use of a nom de plume when necessary, yet we shall require each communication to be signed by the proper name and address of the writer in order that we may correspond with him further regarding matters, should such be necessary to get a better understanding.

Some correspondents write, asking us not to mention the name of the writer and the road, as such might cause them trouble. We are especially anxious to avoid matters which will cause such trouble, but we desire all such subject matter pertaining to everyday practical work which will benefit the men and the railroads which employ them. Above all, we shall not hold up the writer or the road to criticism or ridicule. We shall use judgment in such matters, with a view of getting all the good out of a communication without allowing any bad results to ensue.

Miscellaneous (Air Brake).

92. Explain how a terminal test of the brakes should be made.

A.—All train pipe couplings should be made and angle cocks opened except the one on the rear of the train, which should be closed. All hand brakes should be off. The first test made should be for leaks at the hose couplings and other points in the train line and auxiliary reservoir connections. A service application of about 10 pounds should be made, and examination be made to learn whether all brakes have applied. Care should be taken that all brakes are cut in. The piston travel should be adjusted on all cars to about 6 or 7 inches. When brakes are released, care should be taken to know if all brakes are off and that the brake rigging does not foul at any point on the truck or car framings. The retaining valves should be known to be in operative condition and all handles turned down when not in operation.

93. What is meant by a running test, and how is this test made?

A.—A running test consists of a light application of the brakes by the engineer when the train is pulling out, and before it has gotten up to speed, to be sure that all angle cocks are open and that the brakes are operative.

94. At what points on the road should the running test be made?

A.—At terminals and at all points where the angle cocks have been manipulated to take in or set out cars, etc. It is also the rule on some roads to make a running test at points where it shall be absolutely necessary for the brakes to perform their functions, such as on draw bridges, etc.

95. When should the brakes be released when making a stop with a passenger train of less than ten cars?

A.—Shortly before coming to a dead standstill to allow the brakes to right themselves and thus preventing a shock to the passengers. b. Of ten or more cars? A.—Brakes should be held on until the train comes to a standstill, as releasing to avoid a shock with a long train will frequently break it in two. A two application stop should be made, and the brakes be held on with a light second application until the train comes to a standstill.

96. When should the brakes be released in making a stop with a freight train?

A.—The brakes should be held on until the train comes to a stop, as with a long passenger train of ten or more cars.

97. Why is it dangerous to repeatedly apply and release the brakes on a long train without giving the auxiliary reservoirs time to recharge?

A.—The auxiliary reservoir pressure will become depleted by repeated applications, and the holding power of the brakes be thereby reduced and be insufficient to control the train.

98. When two engines are coupled together in double heading, which engine should have full control of the brakes, and what should the other engine do?

A.—The first engine should do the braking, and the second engineer should close the stop cock under his brake valve, and place the brake valve on lap, thus throwing out of service all of his air brake equipment except the foundation brakes on his engine, which is operated by the leading engine.

99. In case a hose should burst while on the road, what should the engine men do to assist the train men in locating it?

A.—Place the brake valve handle in full release position, thus causing the escape of air at the bursted hose to manifest itself to the brakemen as quickly as possible, easing the steam throttle off to reduce speed of the air pump.

100. How would you apply and release the brakes on a freight train, when only a part of the train is equipped with air brakes?

A.—A reasonable reduction in the train pipe pressure should be made to apply the brakes on the air cars, and when the slack of the train has been bunched, which is indicated by the pushing forward sensation when the slack is taken up, then the brakes may be applied with greater force if desired. In releasing, the straight air brake on the engine and tender should be held on while the train brakes are being released and the slack allowed to run out. This will prevent the slack running out in a manner which will snap the train in two.

101. What precaution should be taken in starting a long freight train with all cars equipped with air brakes, and in operation?

A. The slack should be taken easily until the entire train is stretched, thus preventing a break-in-two which might occur if the slack were taken suddenly.

102. In releasing brakes on a long freight train, what should the engine men do to be sure that the brakes have released?

A.—Leave the brake valve handle in full release position about as many seconds as there are cars in the train, before bringing the brake valve handle to release position.

103. How is the slack taken up on the American outside equalized driver brake?

A.—By a slack adjuster feature on the connecting rod to the bell crank lever.

104. Are the train pipe and auxiliary reservoir pressures equal at all times?

A.—No. b. What time are they equal?

A.—Before the brake is applied, when the triple valve has lapped itself during the application of the brake, and after a release of brakes when the auxiliary reservoir has become fully recharged.

105. How many applications of the brake are necessary to make a stop with a passenger train and why?

A.—The two application top is considered the best in modern passenger train service. The first application should be heavy and sufficient to slow down the train to about 8 or 10 miles an hour, when the brakes should be released before reaching the point at which the stop is desired, and a second and lighter application should be made to finish up the stop, and should be held on until the train is brought to a standstill. If brakes are released on a long passenger train before coming to a full stop, the slack of the train will run out and the train be snapped in two.

106. How would you make a stop on a grade with a passenger train?

A.—By the two application method, holding on the brakes for a second application.

107. Explain the operation of the pressure retaining valve.

A.—When the handle of the retaining valve is turned down it is inoperative. When the handle is turned up in a horizontal position, the free exit for air from the brake cylinder to the atmosphere is cut off and the pressure must pass upward against the weighted valve which has a resistance of 20 pounds. All over this amount will raise the valve and blow off, but all below that amount will be held in the brake cylinder.

108. What benefits are derived from the use of the retaining valve?

A.—On mountain grades the pressure retained in the brake cylinder, by turning up the handle of the valve, will hold the train in check while the auxiliary reservoirs are being recharged for subsequent application of the brake.

109. Name the defects which cause the retaining valve to be inoperative.

A. First, defective packing leather in the brake cylinder. Second, defective union in the retaining valve pipe. Third, retaining valve or pipe broken off.

110. Explain how a stop at a water tank or coal shute should be made with a long freight train.

A.—The engine should be equipped with a straight air brake for this purpose. The train brakes should be used until the speed of the train has been brought down to three or four miles an hour, then released and the straight air brake applied to cover the last few feet of the distance to the desired stop. If the engine is not equipped with the straight air brake it would be better with a long train of all air-braked cars, to stop, holding on the brakes, and to cut off the engine while taking coal and water, as considerable time and damage will be saved by this method.

111. Do you think it poor policy to reverse the engine while the driver brakes are applied?

A.—Yes, tests have proven this.

112. Should the train pipe be blown out before leaving the engine house?

A.—Yes, as cinders or sparks are likely to be gathered in the coupling head or hose.

113. Are the brakes any more liable to stick after an emergency application than after a service?

A.—Yes, as dirt in the train line might work between the emergency valve and its seat, permitting train pipe pressure to pass to the brake cylinder.

114. If, in making a service application, you notice some wheels slide, do you think it good policy to drop sand to start them turning again?

A.—No, a wheel once stopped cannot be started to turning again by sand dropped on the rail, and that process will only cut the wheel worse and make the flat spot longer.

115. Explain the principle of the duplex governor applied to freight engines.

A.—The high pressure head of the duplex governor is connected direct to the main reservoir pressure and is usually set for 110 pounds. The low pressure head is connected to port *f* in the brake valve and is set at 90 pounds. When the brake valve handle is in full release position or running position, the low pressure head is operative, but when placed on lap, there being no main reservoir pressure in port *f*, the high pressure head must govern, thus permitting the pump to compress air during the time the brake valve handle is on lap while making a brake application.

116. Are the results from shocks on passenger trains likely to be expensive and give the road a bad reputation?

A.—Yes.

117. Do you understand the importance of watching the air gauge closely?

A.—Yes.

118. When descending a grade, how much should the speed be reduced before releasing the brake to recharge?

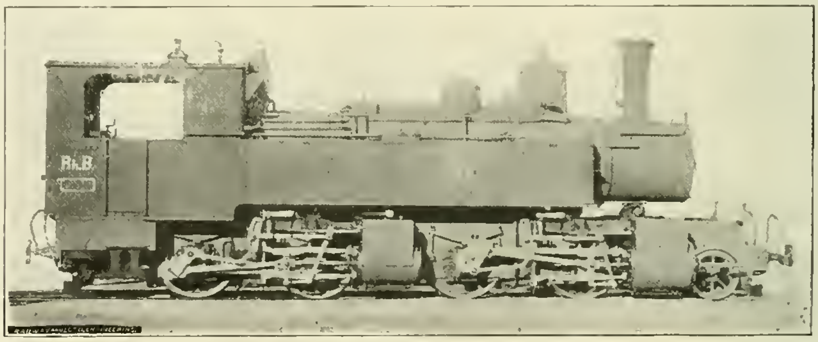
A.—The speed of the train should be brought down to about 10 or 12 miles per hour before recharging. Frequent recharge is preferable to long runs between periods of recharging.

119. What is meant by application of the brakes?

A.—The operation by which train line pressure is reduced to permit of triple valve movement which will send pressure to the brake cylinder.

120. Do you understand that the braking power is considerably more on passenger than on freight cars and on this account greater care must be exercised in handling them?

A.—Yes.



SWISS PASSENGER LOCOMOTIVE.

Questions Answered

Behavior of Injector.

(81) F. K. H., McKees Rocks, Pa., writes:

Suppose you had a Nathan Monitor

injector on your engine that would lift water and work all right 160 lbs. pressure, but when the pressure gets up to 180 lbs., which is the pressure the engine carries, the injector will not take up all the water, and half of the water goes out of the overflow pipe, and in order to save water you have to screw down the front cock of the injector when the pressure is up to 180 lbs. in order to make the injector work. A.—From this it would appear that the trouble with this instrument is in the interior cones or nozzles. The fact that they work at 160 lbs., and begin to waste water when the pressure is raised to 180 lbs., seems to show that the nozzles are worn, and consequently do not condense properly. This statement is based upon the presumption that the nozzles of this injector are of the "high pressure" pattern and are worn unequally. A careful examination of the nozzles would be in order.

(82) H. W. B., Cambridge, Mass.:

Will the electric rolling stock of the Atlantic division of the L. I. R. R. conform to standard steam railroad dimensions, or to the B. R. T. rolling stock? Is the position of the third rail of the L. I. R. R. the same as in the case of the B. R. T., and if not, what provision is to be made in the case of the suburban service (Park Row to Jamaica) rolling stock to enable it to operate on both positions of third rail? A.—The electric rolling stock of the Atlantic avenue division of the Long Island Railroad will conform neither to the standard steam railroad dimensions nor to the standard elevated motor equipment of the Brooklyn Rapid Transit system. We understand that they approach the latter type, though the platforms are higher and the body somewhat longer. The position of the third rail on the Long Island R. R. is further from the running rail than on the B. R. T. lines, owing to the fact that it was necessary to consider all types of steam locomotives, freight cars and hopper bottom cars, the latter presenting a serious possibility of dropping the hoppers, which would ground on the third rail. There is under consideration a combination contact shoe which will provide for operation on lines not standard with the Long Island Railroad.

(83) L. C. B., Covington, Ky., writes:

What is named the running gear of a locomotive? A.—The running gear of a locomotive consists of those parts, such as the wheels, axles and frames, which carry the other parts of the engine.

What is the size limit of a driving wheel journal, also of a truck wheel journal? A.—See description of switching engine on page 399, of this issue of RAILWAY AND LOCOMOTIVE ENGINEERING.

Can you give a rule whereby the cost of a locomotive or a machine of any description can be ascertained by its weight? A.—There is no such rule. In locomotives and machinery generally the lighter, finely fitted and finished parts cost much more than the heavier, coarser parts. In the office of the Appraiser in Custom Houses there are valuation tables for the guidance of inspectors examining machinery whereby an approximate estimate of the cost of production can be made by valuing the various parts of the machines separately.

What is the age limit of a crank pin or driving axle? A.—As a rule crank pins will wear out much sooner than axles, and consequently are more frequently replaced. Neither is gauged by age limit but by distance run and the particular kind of traffic. On some roads axles are running as high as 250,000 miles before being replaced.

DIRT IN THE REDUCING VALVE.

(84) R. E. L., Stroudsburg, Pa., writes:

Why does the whistle blow every time the brakes are let off? It doesn't act that way when the brake is set, either by the brake valve or by opening the cock on the train pipe. Why is it? A.—There is evidently dirt between the supply valve and its seat in the reducing valve, allowing signal line pressure to be equal with the main reservoir. When main reservoir pressure is reduced to release the brake, signal line pressure reduces also, causing the whistle to blow.

BRAKE VALVE ANGLE FITTING REMOVED.

(85) B. G. E., Lebanon, Pa., asks:

If the angle fitting is removed from the train pipe exhaust port of the engineer's brake valve will that make the brake valve more liable to give undesired emergency? A.—Yes, especially if the equalizing piston is clogged up with sand and cinders, making it work hard and sluggishly.

UNDESIRED EMERGENCY TRACEABLE TO THE BRAKE VALVE.

(86) B. G. E., Lebanon, Pa., writes:

On a certain train, two baggage, one express, a smoker, two passenger coaches and a chair car, undesired emergency happens when a certain engine hauls the train, regardless of the fact whether the high speed brake is being used, or the 70-pound brake is used. No other engine on this train will give that trouble. Why is it? A.—It would seem as though the brake on the engine, or the engineer, was at fault. Possibly the equalizing piston of the brake valve is dirty, causing it to move with a jerk and to produce emergency applications.

VIEW OF THE SAINT GOTHARD RAILROAD, SWITZERLAND.

CONDEMNED AIR HOSE.

(87) W. D. S., Fruitville, Cal., writes:

It is not an uncommon thing for air hose to show leaks around the figures and letters on the brand. Is it possible from the fact that the brand being sunken there is less rubber than on the plain surface? A.—Hardly, as the leakage comes from the inside through the different layers of rubber and canvas, and would doubtless escape somewhere through the outer layer of rubber even if it didn't at the label. Poorly made hose, however, might leak at the brand.

THE NEW DISTRIBUTING VALVE.

(88) R. H. M., Alleghany City, Pa., writes:

I notice an advertisement in the 1905 Proceedings of the Air Brake Association, showing the new distributing valve. Is there any descriptive paper out on it yet? A.—No, but the same is being prepared and will be out soon, being presented in these columns as soon as issued.

(89) W. T. Gillett, Clifton, Ore., writes:

Will you kindly tell me what kind of packing is generally used and what is the best for packing a smoke stack tight on the locomotive? I have used asbestos, but that burnt out as the front end gets very hot. A.—The base of the smoke stack should first be carefully fitted to the curvature of the boiler, then a thin coating of cement should be spread on the boiler and the base securely bolted to its place. The cement made by the Smooth-on Mfg. Co., Jersey City, is very suitable for such work.

(90) L. C. B., Cincinnati, Ohio, writes:

We have recently received some new Niles tools, among them a 200-ton hydraulic wheel press, one 42-inch wheel boring machine, and one car axle lathe. We are uncertain about what power will be required to run these tools, and appeal to you for the information. A.—You should not have less than 20 h.p. If all the machines happened to be running at the same moment at their maximum capacity the motor would be overloaded; therefore, if you want to be provided for all possible demands, it would be advisable to have a 30 h.p. motor.

(91) S. S. T., Trenton, N. J., writes:

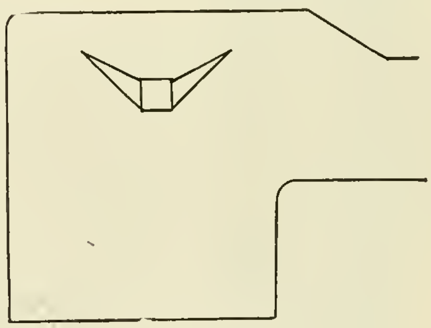
How do you line up the shoes on the frame, when the engine is stripped? A.—In lining up shoes and wedges the utmost care should be observed. The main object in view is to place the axis of the driving wheels square with the frames and parallel to each other, the distance from the center of one pair of wheels to the center of the next pair being the same as the length of the rod which connects them. It is best to use the main jaws to work from, but the front jaws may also be used. If the shoes and wedges are new and planed and fitted to the pedestal jaws and the pedestal braces in place, a tram reaching from an exact center marked on the saddle at a point equi-distant from the frames and reaching to a point on the frames at the center of the pedestal will serve as a starting point for the succeeding operations. The details depend on the size of the driving boxes, the distance from axle to axle, and our space is so limited that we cannot begin to give even a brief account of the best methods. Nearly ten pages are devoted to the subject in "Twentieth Century Locomotives," published by the Angus Sinclair Co., and we earnestly recommend it to the perusal of all who aim at a mastery of the details of this important subject.

Fiery-Footed Steeds.

The visitors at Rockaway had more than their money's worth recently, when a team of horses stopped suddenly while crossing the railway tracks. Their feet flashed fire as they wildly pawed the electrically charged rails. The affrighted people stood back while the horses threw demi-volts in air. The two occupants of the carriage lashed the horses, but to no purpose. The policemen, as usual, were invisible. The fire brigade came to the rescue, but by the time they reached the scene one fine black horse stiffened like a statue and fell over dead. The other danced a kind of death dance with accompaniments of blue fire and white smoke. At last a railway employee called up the power house by telephone and the current was shut off. The engineer is at a loss to know how the rails became charged.

A High Set Spring.

One of our most honored correspondents sends in the annexed spring arrangement, which he says was at one



A HIGH SET SPRING.

time used on certain Norris engines. He asks if any of our readers can send a full picture of one of these old-time locomotives. We should gladly publish the picture and would give it a permanent place in our forthcoming book on the Growth of the Locomotive.

Chicago Pneumatic Tool Company.

The semi-annual statement of the Chicago Pneumatic Tool Company shows the affairs of the company to be in the most encouraging condition. After paying the usual half-yearly dividend a surplus of $376,898.17 is carried forward. About $5,000 has been spent in experimenting with new tools during the same period, while over $52,000 has been expended in renewals and repairs of buildings and plant.

A Coming Captain of Industry.

A Kittery lady thinks the boys of the present generation are getting pretty nervy, says the *Lewiston (Me.) Journal*. A few days since, this housewife observed a youngster of perhaps a dozen years digging dandelion greens on the lawn in front of her house. Thinking it would do the lawn no harm and would help the boy earn a few pennies, she did not molest him. After he had been digging for some time she saw the boy go to her well near by and calmly clean and wash the greens. A few minutes later the lady was surprised upon answering a knock on her door to have the same urchin offer her a peck of greens for only 20 cents.

The location for the next meeting of the Master Car Builders' and Master Mechanics' convention will be determined by the following gentlemen:

Mr. A. E. Mitchell, S. M. P., Lehigh Valley R. R. Co., with office at South Bethlehem, Pa.

Mr. G. W. Wildin, Mech. Supt., Erie R. R. Co., with office at Meadville, Pa.

Mr. F. K. Shults, representing the Supply Men's Association, with office at 95 Liberty street, New York City.

The above mentioned committee have appointed Mr. F. K. Shults as their chairman, and all communications should be addressed to him, care Camel Company, 95 Liberty street, New York City.

There are about 46,000 locomotives in the United States that cost an average of $12,000, an aggregate of about $557,-000,000. The number of new locomotives required annually to keep up the stock is about 1,200. That represents an annual expenditure of about $14,400,000. The people who do the work of building locomotives are not classed as railroad men, but they would find business dull if politicians succeeded in stopping the movement of railroad trains, as some of their policies threaten to do.

Sixteen of the locomotives ordered from Baldwin's by the government of New South Wales were shipped at New York last month on board the Cufic. The price of the locomotives is $18,500 each, and is fifteen per cent. lower than the lowest British bid.

Efforts are being made to get the proposed new shops of the Wabash Railroad to be located at Hagerstown, Md. The shops will employ a large number of men, and would be a very desirable addition to the industries of the city.

The Mexican Central Railroad people are making arrangements to introduce oil fuel for their locomotives. There are good oil wells in Mexico, whose product as fuel will greatly reduce the cost of locomotive operating.

Air Brake Department.

CONDUCTED BY F. M. NELLIS.

Refrain of the Air Brake Defect Card.

Card, brothers, card, and card with care.
Card all cars with defective air.
Card, whenever you hear 'em blow
At the exhaust port, soft and low.

Card when you hear the triple hum.
Card when you think it's stopped with gum.
Card when the darn brake won't release.
Card when it's stuck, as it may need grease.

Card when the triples "dynamite."
Card when the bleeders are not tight.
Card whenever the triple sticks,
Card with a blue card, Form '66.

Card when the reservoirs won't charge.
Card for a leak whether small ar large.
Card so the Air Man can repair,
Card, brothers, card, and card with care.

Card, brothers, card to this refrain,
Card away with might and main.
Card every morning, noon and night,
Card till we get all the d—n cars tight.

A. Stilson Wrench.

Cardville, Tex.

An Object Lesson.

Herewith is an "object lesson" entitled, "A Brake Beam Ambulance on a Southwestern Railroad." Here we have a demonstration of the fallacy of the general idea that all metal brake beams are good.

In looking over this car load of cripples, afflicted with every kind of disease, but mostly with general debility, the layman will ask himself whether the usual remedy for that affliction (iron) would not be the proper course to pursue. Certainly the builders will have to put more material in their product if they expect to have the beams they manufacture stand up to the strenuous labor now imposed upon them. And now, that every one (urged by the Interstate Commerce Commission) is trying to use some of the old rusty ones that heretofore have only been riding around, we can confidently expect a far greater number of brake beam failures than have been noted in the past.

"Practical."

Pine Tree, Oklahoma.

A BRAKE BEAM AMBULANCE ON A SOUTHWESTERN RAILROAD.

Fined for Flat Wheel.

A police court in a certain city pleased thousands of residents by fining a street car line fifty dollars for operating a trolley car with a very bad pair of flat wheels. For months the residents along the line had been annoyed beyond measure by the terrific pounding, and finally the city attorney took measures against the trolley company with the above results.

Increased Pump Capacity.

I wish to say through your valuable paper that there has been a great deal said for and against the use of larger air pumps on locomotives for the present service. I find there is one very valuable feature that can be overcome by having a large air compresser on the locomotive of to-day. There has been various troubles caused from trains parting and running together, owing to the brakes being fully applied on train, and possibly the rear portion being partially equipped with brakes, causing a collision and doing serious damage. I find that the large pumps that are being put out at present have a sufficient capacity to keep enough brakes pumped off on the forward portion to enable the engineer to keep away from the rear portion of the train, by using a little steam if necessary, therefore avoiding the detached portions from coming together and possibly doing a great amount of damage to both cars and lading; consequently, I think the large pump is worthy of consideration by all railroads.

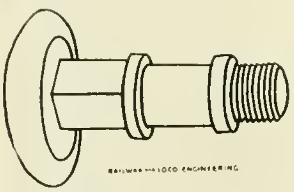
Wm. Owens.

Buffalo, N. Y.

Lubricator Filling Plug.

Inasmuch as the lubricator manufacturers have never constructed a filling plug to remedy the defect, and that I have never seen or learned of one in which the form was changed to resemble that in attached sketch, I am crediting myself with being the originator of the improvement, criticism on which will be received cheerfully.

Lubricator repair men have all noticed that the front condenser pipes of the Detroit Lubricators are nearly always dented in or bent, and many times the attaching plug in body of lubricator is broken off by a wrench in the hands of the engineer when loosening the plug. The Detroit Bullseye Lubricator, after having been in service a short time, will show a worn spot on condenser, which wear might continue through wall in time. With the old style Nathan, the oil glass cap in upper bracket is generally worn off on one corner from the same cause, necessitating the use of an alligator wrench to remove it, and I have seen instances where the bracket was loosened to a leaking point, in one instance the bracket being broken off



LUBRICATOR FILLING PLUG.

entirely by a sudden movement of the wrench. I have found this style of plug an improvement over the old one in all locomotive cylinder lubricators. You will observe that the only difference is that the square is moved up to the top end instead of being in the center as formerly, and a projection is cast at the bottom of the square to hold the wrench up and away from the lubricator body.

E. O. PALMER.

Bloomington, Ill.

Naval Engineers.

The bursting of a boiler in the gunboat Bennington brings again into prominence what may seem incredible, but what is, nevertheless, a fact that the engine rooms of our war vessels are not in charge of trained engineers. Complaints of the result of the incompetency of these men have been made before. In the case of the new battleship Maine, the troubles that occurred in the trial trips were attributed by the skilled engineers in the employ of the Cramp Shipbuilding Company to the lack of mechanical knowledge on the part of officers in the engine room. The Secretary of the Navy has recently attempted to reconstruct the engineer corps by methods outside of the law regulating the Department. He took the liberty to detail officers, upon their own election to engineering duties, with a view to specialization, which is essential to good results in all branches of civil life. If the appalling calamity on the Bennington results in aiding the efforts of the Secretary, some good may come of the disaster.

There is, perhaps, no sphere of human activity where efficiency is more essential to the best results than in the handling of the multiplex appliances used in the development of steam pressure. In the merchant marine service a young man aspiring to the position of engineer finds an apprenticeship of five years in a machine shop as a prerequisite. He may then be able to secure a position in the oil room of a steamship where, after two years of service, he may qualify himself to be examined for the position of fourth assistant engineer. Under the most favorable conditions it will be ten or a dozen years before he can hope to be trusted with the chief charge of the engine room. In the navy there is little or no practical apprenticeship. It is nearly all theory and class-room lectures. Engineers, so called, are notoriously ignorant and indifferent in matters of practical application. It is necessary to pass some time in the engine room on their way to promotion. It is military titles and fuss and feathers and gold lace they are after. Officers who may be specially trained for the engineer corps are by favoritism assigned to deck duty. Line officers without proper political backing are sent below. Admiral Melville in two annual reports complained of the difficulty in keeping competent officers in the engine room. The officers themselves insist that the engine room force should consist of one commissioned officer and a lot of warrant machinists. The wonder is that in such circumstances there are not more disasters. These facts may have nothing to do with the blowing up of the Bennington, and they may have a great deal to do with it. It is admitted that the boilers were unsafe, and it is safe to say that a competent engineer would not have permitted their use in such condition.

From the report of the Court Martial published on August 22, it appears that "on the day of the explosion on the Bennington, after both boilers had been filled and the furnaces started, it was observed that the steam gauge on boiler 'B' showed about five pounds of steam pressure, and at this time Oiler Frank De Courtani, acting as water tender, directed D. N. Holland, fireman, second class, to close the air cock on boiler 'B'; that the said Holland climbed up and closed a valve and almost immediately the steam gauge on boiler 'B' failed to register any pressure; that this was apparently not noticed by either the water tender or the fireman, and no attention appears to have been paid to the fact that the steam gauge failed to register, but they kept on working the fires and firing heavily; that when the steam gauge on boiler 'A' showed 135 pounds there was no pressure showing on the steam gauge of boiler 'B'."

"The court is of the opinion that the explosion was caused by excessive pressure in boiler 'B,' which came about first by shutting the valve connecting the boiler with the steam gauge, instead of the valve on the air cock alone, as was intended, so that the steam gauge did not indicate the pressure in the boiler; second, by unusual and heavy firing in the boiler to get up a pressure which the gauge failed to show; third, by the failure of the sentinel and safety valves to lift at the pressure for which they were set, and the pressure increased without relief until it was beyond the strength of the boiler, which gave way in its weakest part, afterward found to be the corrugated flue of No. 2, the lowest or middle furnace, which collapsed." Conditions similar to these never existed on any locomotive engine and never could exist anywhere except in the government service.

With regard to locomotive engineers, it may be said broadly that there are no class of men who serve as long a time as they do in order to become competent in their calling. Long experience has shown that a lengthened period of service as fireman is not only the best course of training, but the only course calculated to completely familiarize the embyro engineer with the multiplex details of a locomotive. Ten years and even more is not an uncommon length of service before being trusted with a switching or freight engine. The result is manifested in the general high class ability of locomotive engineers and the rarity of disasters similar to that which befel the boilers of the Bennington. Let the navy take a lesson from the merchant marine or railway service and make their engineers pass five years' service in a machine shop or ten years firing a boiler, or what is perhaps better, give them both periods of service added together and the result would be to the credit of the American navy.

The Standard Steel Car Company, of Butler, has received an order for 1,000 steel hopper cars. The cars will be of the 100,000 lbs. capacity, and delivery will begin within the next three months.

Facts alone are wanted in life.—*Hard Times.*

Consolidation 2-8-0 for the Colorado-Utah Construction Company.

The American Locomotive Company has just completed a number of ten-wheel consolidation locomotives for the Colorado-Utah Construction Company, which embody all of the best features of that class, together with several important modifications and improvements, the most notable of which is an adjustable hood on the smoke stack and which is opened or closed by the action of an automatic air cylinder and piston attached to the smoke stack and of which the accompanying illustrations will give an adequate idea of operation.

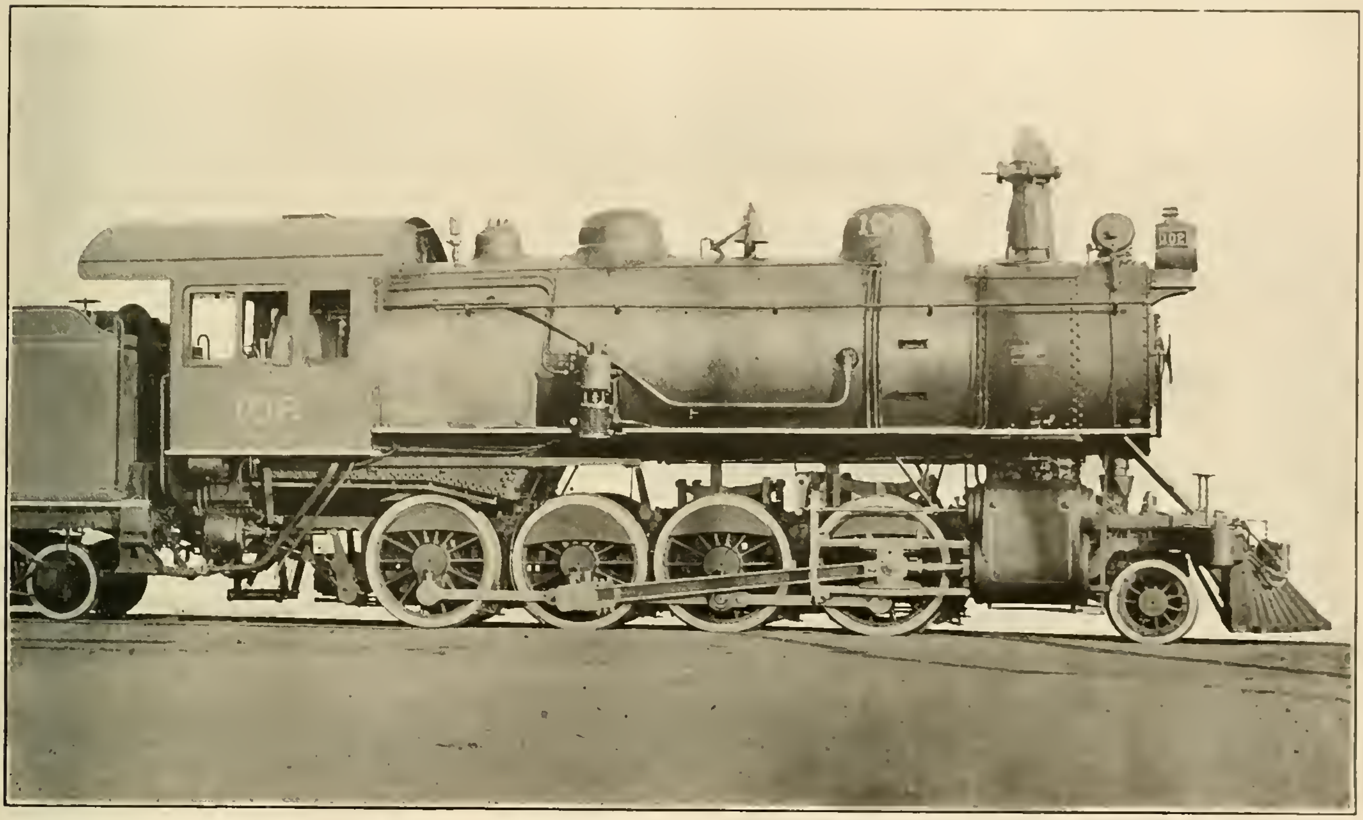
These engines possess the elements of great strength with general simplicity of design and are well adapted for work on steep grades and other heavy work where great speed is not required. The cylinders are 22 ins. in diameter by 28 ins. length of stroke. The short wheel base, 15 ft. 8 ins., gives the engine great cohesive quality which with a tractive power of 42,420 lbs., places them in the front rank of high traction engines. The total length of engine and tender is 56 ft. 10¾ ins. The weight of the engine in working order is 209,500 lbs., and engine and tender together foots up to 343,800 lbs.

The boiler is the usual extension wagon-top type, the outside diameter at the front being 76¾ ins. The flues are 426 in number with a length of 15 ft., and 2 ins. in diameter. The fire box is 9 ft. in length by 6 ft. in width, making a total grate area of 54 ft. The thickness of the crown sheets is ⅜ in., the tube of the boiler being 9 16 in. in thickness, the side water spaces being 4½ ins. in width. The crown staying of the boiler is of the radial kind, and the total heating surface extends to 3,504 sq. ft. The boiler is calculated at a working pressure of 210 lbs.

The driving journals of the main axles are 9½ ins. by 12 ins., the others being 9 ins. by 12 ins. The engine and tender are equipped with Westinghouse American Automatic and straight air brakes, with safety valve.

The slide valves are of the piston type, 12 ins. in diameter, with a travel of 6 ins., and a steam lap of 1 in. The valves are set line and line in the full forward motion, and at one-quarter of cut-off have ¼ in. of lead. The piston rods are 4 ins. in diameter furnished with cast iron snap rings. The outside diameter of the driving wheels is 57 ins., and the tender wheels are 33 ins. in diameter, of the Paige cast iron plate center variety with cast steel tires.

The smoke stack has a variable diameter of 14 ins. and 16½ ins. The height of the stack proper is 16 ft. 6 ins. above the rail, and with the hood attachment measures 17 ft. 10 ins. above the rail. The hood is claimed to have several advantages over the ordinary straight-mouthed smoke stack and the working of this latest addition to the details of smoke box and smoke stack will be watched with interest.



CONSOLIDATION ENGINE, BUILT FOR THE COLORADO-UTAH CONSTRUCTION COMPANY.

A young Irishman, returning home after gathering dollars in America, decided to give his old father an outing and take him to Dublin to see the sights. It was a great event for the old man, who had never been in a train before; but he entered it in fear and trembling, amid many outspoken anticipations of what would happen to him. All went well until the train suddenly dashed into a tunnel, when bang went the old man's fist on his son's nose, as he exclaimed, "I told you something would happen, you young villain; I've lost my sight!"

It is reported that the Kennefick Co., of Kansas City, has secured the contract for building the Western Pacific. The road will extend from Salt Lake City to San Francisco. It is financed by the Goulds and will cost $11,000,000.

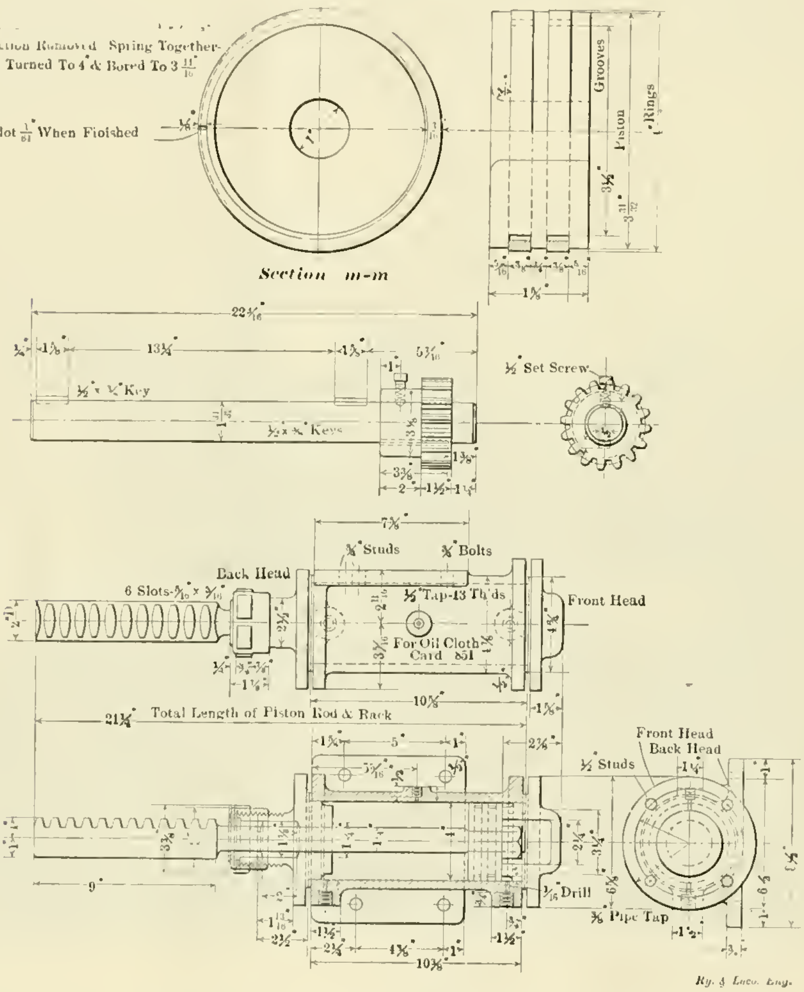
In some of the western roads a new device is being warmly welcomed in the addition of a handrail on the top of the back of the seats in passenger cars, the idea being to provide a suitable handhold for persons getting up from the car.

Increase of Rolling Stock on the Erie.

The Erie Railroad is preparing for an immense business, both passenger and freight, in the near future. Over one hundred engines have already been added to the motive power this year. The Baldwin works in Philadelphia are to supply forty more, besides a large order which we are told has been given to the Rogers Company.

Besides the locomotives the Erie is stocking up in freight and coal cars on a generous scale. Three or four thousand new box cars are about to be built, to say nothing of cars of other types for special lines of freight. Three hundred refrigerator cars are a part of the new equipment, besides combination cars and milk cars.

The Erie is sparing no expense either in construction or equipment to make itself one of the leading lines of the country. Costly construction work is in progress, to place the road on a low-grade basis from New York to Chicago, and there is every appearance of a growing local traffic besides an increasing popularity with the shippers of the great West that keeps the Erie busy.



DETAILS OF MOTOR FOR MOVING SMOKE STACK HOOD.

In Other Lands.

Several of the new locomotives ordered by the Egyptian State Railways have arrived at Cairo and are being placed in service. They are of the Atlantic type, and weigh 120 tons. They were designed and built by the Société Francaise des Constructions Mecaniques, at Denair, France.

The Transvaal Contracting and Engineering Syndicate is interesting itself in a new project to project a branch Premier line to the new tin-fields at Bushveld. The junction will be made at Pienaar's River Station or thereabout.

An extensive order for steel-framed buildings for engineering shops in Japan has been received by Messrs. Brownlie and Murray, of Glasgow, Scotland. These buildings will require thousands of tons of steel.

Mr. H. W. Morley, of Bradford, England, has patented a new arrangement of piston valves for vertical engines worked by a triple releasing gear similar to the Corliss mechanism. Four piston valves are fitted, two at each end of the cylinder, and are surrounded on all sides except the periphery with steam. The device is highly spoken of.

A syndicate has been formed in Germany for constructing the Zoelly turbine. The Krupps, of Essen, are interested in the company, and a notable success has been already realized with a 30,000 h.-p. turbine at work in the Central Station at Muhlhausen, in Thuringia. The motive power is obtained by the direct impact of steam jets against the vanes of revolving wheels.

Messrs. Mather and Platt, of Manchester, Eng., are believed to be the first to supply cast iron tanks for general use. The plates are of a special unit machined true, from which tanks of every size and shape can be constructed. The cost of erection is small. The joints are made with ordinary red-lead putty, and when finished the tank is drop dry and ready for use.

The Lancashire & Yorkshire Railway Company have inaugurated their steam motor car service by introducing a new steam vehicle which has been built at the company's works. It has a total length of 58 ft., and is said to be making high records for speed.

Improved Automatic Bulletin.

For the greater convenience of its patrons the Chicago & Alton Railway has installed at a number of its stations (with the intention of extending the service as rapidly as possible to other points) an automatic electric device known as the train bulletin. The electric bulletin is, in appearance, like a large clock. A hand or pointer is moved upon the dial, indicating whether the train is on time, or if not, the number of hours or minutes late. These electric bulletins are placed in station waiting rooms and in the principal hotels in cities and towns through which the Alton trains are run. They are all controlled by the operator at the station. All bulletins, in the waiting rooms and in the hotels, register similarly at one and the same instant. The operator indicates on the bulletin the number of the train next due to arrive and the time of its arrival. The machinery is similar to a telegraph instrument controlled by a telegraph key, and simple enough to be worked by a child.

A singular accident occurred on the Erie Railroad at Crawford Junction last month, when two engines went into what is known as the "bottomless pit." A work train had stopped when the track began to settle. Another engine came to the rescue and also went down.

The press is a mighty engine.—*Pickwick Papers.*

Of Personal Interest.

Mr. W. S. Murrian has been appointed master mechanic of the Southern at Spencer, N. C.

Mr. J. Davis has been appointed master mechanic of the Pennsylvania, with office at Altoona, Pa.

Mr. I. R. Wells has been appointed storekeeper of the Wabash, with headquarters at Moberly, Mo.

Mr. H. W. Stanley has been appointed trainmaster of the Birmingham division of the Seaboard Air Line.

Mr. E. Stenger has been appointed superintendent of the Union Pacific, with headquarters at Denver, Col.

Mr. C. A. Stetlar has been appointed trainmaster of the Great Northern, with headquarters at Rugby, N. D.

Mr. Jackson Smith has been appointed assistant to Chief Engineer Stevens of the Isthmian Canal Commission.

Mr. Frank A. Devere has been appointed trainmaster of the Southern, with headquarters at Selma, Ala.

Mr. M. A. Hansen has been appointed division engineer of the Arkansas Southern, with office at Rushton, La.

Mr. Geo. J. Gould has been elected president of the St. Louis, Watkins & Gulf, with headquarters at New York.

Mr. A. Crable has been appointed division engineer of the Chicago & Erie, with headquarters at Huntington, Ind.

Mr. G. Willius, Jr., has been appointed mechanical engineer of the Great Northern, with office at St. Paul, Minn.

Mr. D. Sweeney has been appointed roadmaster of the Missouri, Kansas & Texas, with headquarters at Atoka, I. T.

Mr. G. O. Hammond has been appointed mechanical engineer of the Erie, with headquarters at Meadville, Pa.

Mr. J. B. Elliott has been appointed master mechanic of the Baltimore & Ohio, with office at New Castle Junct., Pa.

Mr. J. Kirkpatrick has been appointed master mechanic of the Baltimore & Ohio, with headquarters at Cumberland, Md.

Mr. J. H. Johnston has been appointed assistant engineer of the Missouri Pacific, with headquarters at Nevada, Mo.

Mr. S. H. Busby has been appointed division engineer of the Missouri Pacific, with headquarters at Fort Smith, Ark.

Mr. A. P. Prendergast has been appointed assistant master mechanic of the Mt. Clare shops of the Baltimore & Ohio.

Mr. L. P. Atwood has been appointed superintendent of the Litchfield & Madison, with headquarters at Edwardsville, Ill.

Mr. A. G. Trumbull has been appointed assistant mechanical superintendent of the Erie, with headquarters at Meadville, Pa.

Mr. F. W. Rhuark has been appointed acting master mechanic of the San Francisco, with headquarters at Cape Girardeau, Mo.

Mr. L. J. Ferritor has been appointed superintendent of the middle division of the Wabash, with headquarters at Decatur, Ill.

Mr. Edgar Shellabarger has been appointed master mechanic of the East Broad Top, with headquarters at Orbisonia, Pa.

Mr. Eugene Zimmerman has been chosen president of the Chicago, Cincinnati & Louisville, with office at Cincinnati, O.

Mr. T. Scully has been appointed division storekeeper of the Atchison, Topeka & Santa Fe, with office at La Junta, Col.

Mr. N. C. Van Natta has been appointed chief engineer of the Kanawha & West Virginia, with office at Charleston, W. Va.

Mr. T. H. Sears has been appointed superintendent of the Missouri division of the Santa Fe, with headqurters at Marceline, Mo.

Mr. Wm. H. Averell has been appointed assistant superintendent of the Southern Pacific, with headquarters at Bakersfield, Cal.

Mr. Samuel Rockwell has been appointed chief engineer of the Lake Erie, Alliance & Wheeling, with headquarters at Cleveland, O.

Q. A. Parker has been appointed division storekeeper of the Atchison, Topeka & Santa Fe, with headquarters at Argentine, Kan.

Mr. F. A. Peterson has been appointed division engineer of the Chicago Great Western, with headquarters at Des Moines, Ia.

Mr. E. E. Crysler has been appointed master mechanic of the Cincinnati, Hamilton & Dayton, with headquarters at Indianapolis, Ind.

Mr. A. C. Watson has been appointed assistant chief engineer of the Indianapolis and Vincennes division of the Pennsylvania Lines West.

Mr. E. Abrahamson, roadmaster of the St. Louis & San Francisco, has removed his headquarters from Oklahoma City, to Lawton, Okla.

Mr. A. F. Reiner has been appointed trainmaster of the Iowa division of the Chicago & Northwestern, with headquarters at Boone, Ia.

Mr. H. B. Lautz has been appointed assistant to general manager of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan.

Mr. J. B. Smalley has been appointed superintendent of the Kansas division of the Chicago, Rock Island & Pacific, with office at Topeka, Kan.

Mr. H. P. Meredith has been appointed assistant engineer of motive power of the Pennsylvania Railroad, with headquarters at Jersey City, N. J.

Mr. E. Connelly has been appointed assistant road foreman of engines of the Baltimore & Ohio, with headquarters at Cumberland, Md.

Mr. H. P. Callendar has been appointed division master mechanic of the New York, New Haven & Hartford, with headquarters at Roxbury, Mass.

Mr. Arthur S. More has been appointed engineer of maintenance of way, of the Michigan division of the Big Four, with headquarters at Wabash, Ind.

The office of Mr. George H. Trenary, division superintendent of the Chicagc & Eastern Illinois, has been removed from Villa Grove to St. Elmo, Ill.

Mr. J. W. Hunter has been appointed superintendent of the northern division of the Grand Rapids & Indiana, with headquarters at Grand Rapids, Mich.

Mr. A. M. Brooker has been appointed roadmaster of the northern district of the Chicago, Rock Island & Pacific, with headquarters at Chickasha, I. T.

Mr. J. A. Christie has been appointed road foreman of engines of the Atchison, Topeka & Santa Fe Coast Lines, with headquarters at Los Angeles, Cal.

Mr. A. S. Wordle has been appointed engineer of maintenance of way of the Wheeling division of the Baltimore & Ohio, with headquarters at Wheeling, W. Va.

Mr. E. G. Bryant has been appointed division master mechanic of the Fort Worth divsion of the International & Great Northern, with headquarters at Mart, Tex.

Mr. E. Pennington has been elected vice-president and general manager of the Minneapolis, St. Paul & Sault Ste.

Marie, with headquarters at Minneapolis, Minn.

Mr. C. J. Bushmeyer has been appointed acting master mechanic of the Denver, Enid & Gulf, with headquarters at Enid, Okla., Mr. W. E. McEldowney having resigned.

Mr. Theo. Speiden, Jr., formerly assistant engineer of the Louisville & Nashville, has been appointed roadmaster of the same road, with headquarters at Nashville, Tenn.

Mr. C. W. Card, formerly trainmaster of the Chicago, Burlington & Quincy, has been appointed assistant division superintendent of the same road, with headquarters at Aurora, Ill.

Mr. B. B. Kelliher has been appointed chief engineer of the Grand Trunk Pacific. He will have charge of the construction of the western section of the new transcontinental road.

Mr. T. R. Stewart has been appointed master mechanic in charge of the Philadelphia, Baltimore and Shenandoah divisions of the Baltimore & Ohio, with headquarters at Riverside.

Mr. Herbert Murphy has been appointed division engineer of the Missouri Pacific, with headquarters at Kansas City, Mo. Mr. Murphy has charge of the construction of new yards.

Mr. C. M. McLain has been appointed division master mechanic of the San Antonio division, Taylor to Laredo inclusive, of the International & Great Northern, with headquarters at Taylor, Tex.

Mr. C. G. Delo, formerly division engineer of the Chicago Great Western, has been appointed engineer of maintenance of way of the western division of that road, with headquarters at Kansas City, Kan.

Mr. M. B. Murphy has been appointed trainmaster of the El Paso & Southwestern, with headquarters at El Paso, Tex. Mr. Murphy will have jurisdiction between El Paso and Santa Rosa, including branches.

Mr. H. A. Childs has been appointed superintendent of motive power of the Guayaquil & Quito Railway in Ecuador. Mr. Childs was formerly master mechanic of the Erie, with headquarters at Jersey City, N. J.

Mr. G. F. Cotter, formerly division superintendent of the Colorado & Southern at Trinidad, Col., has been appointed general superintendent of the Fort Worth & Denver City, with headquarters at Fort Worth, Texas.

Mr. F. H. Hammill, formerly trainmaster of the Iowa division of the Chicago & Northwestern, has been appointed assistant superintendent of the Madison division of the same road, with headquarters at Baraboo, Wis.

Mr. Frank T. Dolan, heretofore general superintendent of the Fort Worth & Denver City, has been appointed general superintendent of the southwestern district of the Chicago, Rock Island & Pacific, with headquarters at Topeka, Kan., succeeding Mr. J. O. Crockett, resigned.

William T. Simpson, formerly with the Detroit Lubricating Co., and more recently with the American Locomotive Equipment Co., has accepted a position with S. F. Bowser & Co., of Fort Wayne, Ind., manufacturers of the Bowser oil storage systems and oil house equipments.

We are much pleased to report that Mr. Barney Donoughue has been promoted to be general foreman of shops of the Missouri Pacific, with headquarters at De Soto, Mo. Mr. Donoughue is 28 years of age, and served his time in these shops and has always been a close reader of RAILWAY AND LOCOMOTIVE ENGINEERING.

The Pratt & Whitney Co., of Hartford, Conn., have made arrangements with the C. T. Patterson Co. Ltd., of New Orleans, La., to represent their small tool department in the Southwest territory. The Patterson Co. have a very complete line of the small tool product, and are in a position to fill orders from their New Orleans establishment.

Mr. Harvey Walters, for many years foreman in the boiler shop in the repair shops of the Manhattan Railroad Company in New York City, is now in charge of the extensive boiler shops of the American Locomotive Company at Scranton, Pa. Mr. Walters is fortunate in having in his department the latest and best mechanical devices known in the trade. Mr. Walters is a native Pennsylvanian, but much of his education and training in applied mechanics was acquired in New York while attending the evening classes of the Cooper Institute, where he graduated in the regular mechanical course with high honors.

Death of Mr. Frederick Schuchman.

We regret to learn of the death of Mr. Frederick Schuchman, the genial and gentlemanly president and manager of the Homestead Valve Manufacturing Company, at his home in Homestead, Pa. Mr. Schuchman was a mechanical engineer of marked ability, a scholarly, courteous and genial gentleman, and had the respect and esteem of all who knew him. His death is especially regretted by the employes of the company, in whose welfare he had shown the warmest interest.

Anything that makes a noise is satisfactory to a crowd.—*Dickens.*

The Union Pacific Railroad has just issued an illustrated booklet on the Lewis & Clark Centennial, which is a complete guide to Portland, the Exposition and the Northwest generally. The large birds-eye view map, in colors, is the best work of its kind that we have ever seen.

The Kilgore-Peteler Company, of Minneapolis, Minn., have issued a handsome catalogue descriptive of dump cars, steam shovels and other general railroad appliances. Recent improvements on their dump cars place them in the front rank in this special department, while all their product is of a high class order.

Mr. B. E. D. Stafford, General Manager of the Flannery Bolt Company, Pittsburgh, Pa., has published a masterly essay on locomotive water space stays, which is published in pamphlet form and is well worthy the attention of all who are interested in boiler construction.

A very interesting picture has come to us from the Union Pacific Railroad Company, recalling the journey of General U. S. Grant and party over the then unfinished railroad in 1867. The scene depicts the party at Fort Sanders, near Laramie, in Wyoming, and besides the famous soldier are Generals Sherman, Sheridan, Dodge and others.

The Armstrong Bros. Tool Co., of Chicago, have been compelled to look for larger quarters to accommodate their rapidly increasing business. They have found an excellent location in N. Francisco avenue, and occupy the extensive premises running from No. 104 to 124. It need hardly be said that with larger facilities and the constant adoption of every new device calculated to perfect their multiplex mechanical appliances, the firm will easily maintain the enviable reputation they have made in their special line. As "The tool-holder people," they have earned a unique place among the manufacturers of improved machinery.

A beautifully illuminated catalogue with copious illustrations has just been issued by the Baldwin Locomotive Works, Philadelphia, Pa. Its design is rather to present a record of recent construction than a general catalogue. The work contains information pertaining to a great variety of locomotives, of different gauges and for different kinds of work; representing all the imaginable requirements of locomotive service from the massive balanced compounds, built for the New York Central, or the high wheeled Atlantic type, built for the Wabash Company, to the lighter ten-wheel locomotives built for the Seoul Fusan railway of Corea. Complete details of the dimensions are given. The illustrations are on tinted paper in the highest style of the art, while the letter press is perfection itself.

The Railway Electric Power Company, 118 Liberty street, New York, have just issued a very interesting compendium of the main features of the "Ganz System," embracing a complete description of their alternating current three-phase traction for rapid transit especially for suburban and interurban lines, as well as for mining and industrial railways. The work is of great value as the minute description of the electric installation on the Valtellina line furnishes an example, noteworthy in every respect, of electric traction. The chief officials of railways will find the contents of the book of much interest. Numerous illustrations accompany the text.

Southern Quarantine Notices.

All railways entering New Orleans issued notices in the first week of August that all local passenger trains to and from New Orleans were discontinued. The railway companies are maintaining through passenger service without interruption, but desire it to be known that they assume no liability for any detention to passengers by reason of quarantine regulations. The Pullman car service from the North stops at Montgomery, Ala.

The Morse Chain Company.

The Morse Chain Co., of Trumansburg, N. Y., are installing a greatly increased plant at Ithaca, N. Y. Under the able management of Mr. F. L. Morse the product of the company has come into great popular favor. In their special line of power transmission chains there are now in service chains transmitting over 75,000 horse power, single transmissions ranging as high as 500 horse power being in operation.

Little Elsie was on a railway journey. When her mother put her to bed in the sleeping car at night the child was requested to say her prayers, as usual.

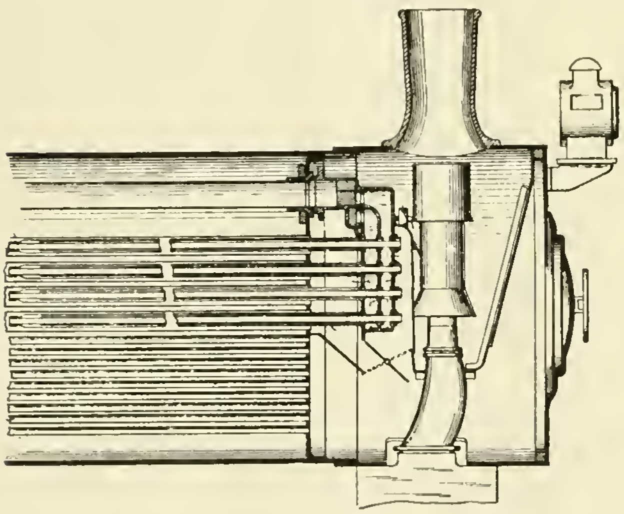
"Oh, what's the use of bothering God about it to-night?" she demanded. "The engineer'll take care of us all right, won't he?"

Be careful to develop your talents.—*Tale of Two Cities.*

At Scranton, Pa.

The D., L. & W. Railroad authorities at Scranton, Pa., have been experimenting with superheaters on two locomotives for several months, and it was particularly interesting to have the pleasure of hearing the experiments described by the veteran Mr. David Brown, the assistant superintendent of motive power, and his able inspector, Mr. John W. Maysilles, who has accompanied the locomotives in their daily trips.

The engines are of the American passenger 4-4-0 type, built at Schenectady, and began running in May this year. They are of the culm-burning, Wooten fire box kind, peculiar to the coal regions. No. 953 was furnished with the Richardson balanced slide valve, while No. 955 was equipped with piston valves. Both were also furnished with the Richardson oil pump, as manufactured by the Sight Feed Co., of Milwaukee. The oil pump is driven either by air or steam, and has a perfectly positive arrangement, whereby it will pump if there is oil in the receiver.



THE SCHENECTADY STEAM BOILER SUPERHEATER.

The superheaters were of the Schenectady type, designed by Mr. Cole, the accomplished engineer of the American Locomotive Company, and consists of a vertical row of superheating tubes, with systems of superheater pipes therein as shown in our illustration, comprising, in each tube, an inner pipe which is open at both its ends, an outer pipe fixed to the inner pipe forward of its rear end opening, and an intermediate open-ended partition-pipe, also a T head divided into two chambers, one opening to the main supply pipe and the other to the steam delivery pipe. It will be readily seen that with suitable attachments the superheating pipes add to the main steam pipes an increased degree of heat from their proximity to the fire. The advantage of thus superheating the steam has been satisfactorily demonstrated on stationary engines, chiefly on account of a high temperature being maintained throughout the length of the piston stroke. The same results have shown themselves on locomotive practice, with this difference, that the problem of effective lubrication of the working parts has been found to be peculiarly difficult.

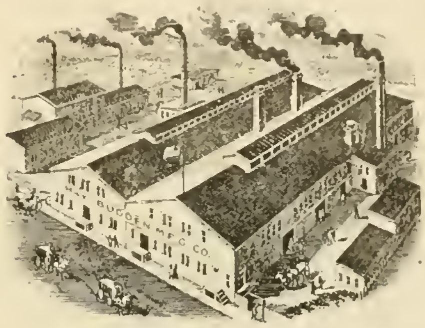
In the case of No. 953, the experiments were abandoned owing to the difficulty of keeping the valve faces lubricated. In the case of No. 955, the engine with the piston valves, the experiments are being continued with generally gratifying results. When the valves are running smoothly the engine is said to do splendid work, running occasionally over 70 miles an hour with 7 heavy passenger cars. The consumption of oil under ordinary conditions is about 4 pints each trip, while on the engine with the superheaters it amounts to 5½ pints, showing an increase of more than one-third over the other engines.

The conditions of the road are particularly hard, with occasional double curves and many heavy grades. The distance between Scranton and Elmira, 119 miles, with five or six stoppages, is traversed in a little over 2 hours. The question of fuel consumption has not been seriously considered owing to the fact that in the culm burner the item of fuel is not a very important one. The effective work of No. 955 under favorable conditions surpasses that of any other engine of its kind not furnished with superheaters. Its superiority is not determined with a sufficient degree of minuteness to make an exact comparison. It seemed to us that the oil pipes and their attachments near the valves were not strong enough to suit the conditions of extraordinary vibrations incident to the service, and that a thorough reconstruction along heavier lines was necessary to insure perfect lubrication. This might also be better effected if, in addition to the positive lubricator, the feed pipes were so connected that the oil would be led to both ends of the valves and cylinders. It should also be possible to vary considerably the amount of oil fed per minute, as superheater engines, even more than the ordinary type, require more oil when working slowly at long cut-offs than at other times, on account of the high temperature being maintained throughout the stroke.

Difficulties have also been experienced with the parts of the superheaters nearest the fire, the intense heat readily affecting the parts and causing leakage. The promoters are seemingly very confident of eventually overcoming these minor troubles, and look upon the introduction of the superheater in locomotives as an assured success.

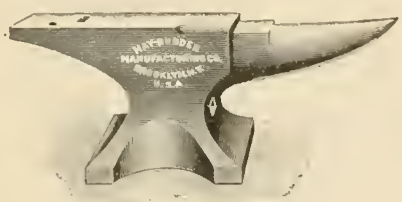
The Hay-Budden Anvil.

The manufacture of anvils by the Hay-Budden Manufacturing Company, of Brooklyn, bids fair to lead all others in that particular branch of industry. In



HAY-BUDDEN ANVIL WORKS.

the dozen years that have elapsed since the firm was established their premises have extended from a very small beginning until the works now cover several acres and extensions are still going on. The firm have perfected many improvements in the manufacture of their anvils and invented many labor saving devices, and it is interesting to watch the progress of the shapeless mass of scrap iron through the various stages of its formation into the finished product. There are three parts that go to make



THE HAY-BUDDEN ANVIL.

up the whole and consist of a wrought iron base which, having its origin in a rude square block of hammered iron, is placed in a die and forced into shape by a powerful hydraulic press. The wrought iron body undergoes a similar operation and after a bar of steel has been welded to the face and the horn shaped by hammering, the final structural operation of welding the body and base together takes place, and before the ponderous mass has time to cool the hardening of the face occurs and the anvil is ready for the finishing polish on the swiftly revolving grindstones.

The ingenious arrangement of furnaces and cranes and steam hammers and dies and presses is such that the amount of manual labor is reduced to a minimum, the hammering of the horn into shape being about the only operation performed by hand. The most surprising feature, perhaps, is the variety of sizes and even shapes, so far as the proportion of parts is concerned, that the anvils assume. The skilled workmen recognize at a glance the size of the particular die which the billet will fill, and when the hydraulic presses close on the molten mass scarcely a particle of scrap or fringe is left. The result is that while the anvils are all made of the best carefully selected iron and specially prepared steel, and are repeatedly subjected to prolonged hammering, the finished article has the appearance of a fine casting.

A hundred anvils per day is ordinary work for the 140 men employed in the works, and the output is constantly increasing. The company's many important improvements have so lessened the cost of the anvils that they have practically now a monopoly of the business in America, while the rapidly increasing demand in Europe, Asia and Africa indicates that the British manufacturer will shortly have to give way to the more enterprising American manufacturer.

Steel Rolling Doors.

The Kinnear Manufacturing Company, of Columbus, Ohio, has been compelled to look for larger quarters on account of their rapidly increasing business and have secured an extensive site on Fifth avenue near the Big Four Railroad. Mr. Vance, the able manager, informs us that in addition to a steadily growing demand for their steel rolling doors and shutters in America, the orders from foreign countries have greatly increased during the year.

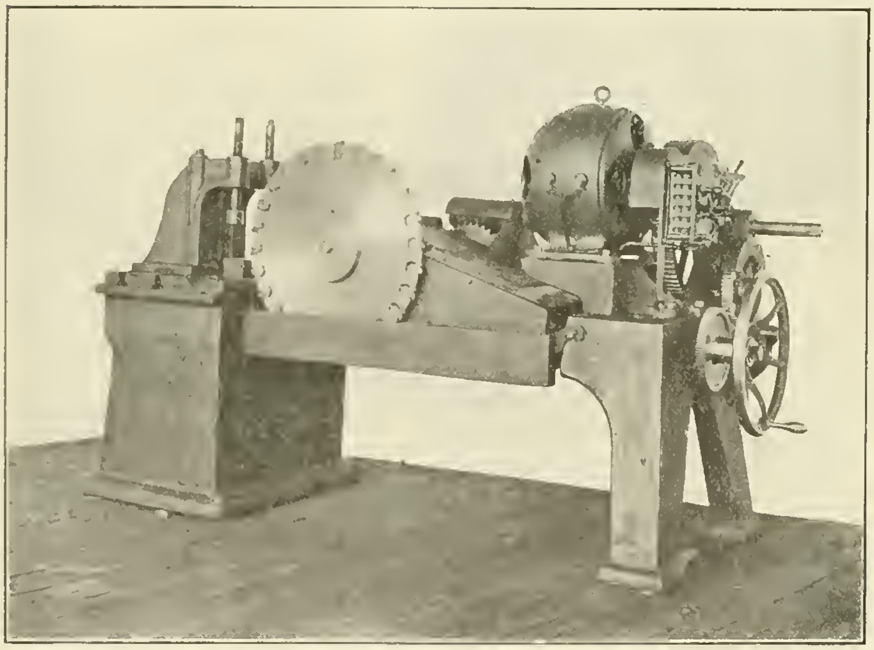
We had the opportunity of examining the construction of one of the steel rolling doors measuring 35 ft. by 21 ft., and weighing over 8,000 lbs. So evenly balanced was this weight by the neatly inclosed coiled spring that the door could be readily lowered or raised by hand. Some of the best equipped railroads are having their roundhouse doors fitted up by the Kinnear method. Mr. E. H. McCloud, the company's mechanical engineer, has perfected some improvements recently which render the doors and shutters of special value in cases of fire.

A life without a purpose is a languid, drifting thing: our improvement is in proportion to our purpose.

Rapid and Powerful Cold Saw.

Our illustration shows a good example of a modern, strongly made and rapid cutting cold saw. It is in some respects very like the No. 3 bar cold saw which appears on the pages of the Espen-Lucas catalogue of cold saw and cutting-off machines. This firm is located in Philadelphia, and the machine of which we write is the result of the endeavor to produce a much more powerful and rapid cutting-off tool.

The illustration shows the machine to be motor driven, which gives it a very compact appearance, and the saw used in this particular machine is one of the Taylor-Newbold type made by the Tabor Manufacturing Company, of Philadelphia. The drive is through a hammered crucible steel worm with phosphor bronze worm wheel, the gearing having been cut out of the solid.



ESPEN-LUCAS NEW MOTOR DRIVEN COLD SAW CUTTING-OFF MACHINE.

The machine has a variable automatic feed and safety stop which throws out the feed at any depth of cut. The clamps can be placed at any angle on the platen when it is desired to make an angle cut. The clamps can also be entirely removed when large or odd-shaped work has to be cut.

The saw itself, referred to above, is one with inserted teeth and is capable of high speed and deep cuts. This machine has cut 6-in. steel bars, containing .25 per cent carbon, at the rate of one every six minutes. The machine is made as desired for belt or motor drive. The makers will be happy to furnish further information on request.

We count by changes and events within us. Not by years.—*Battle of Life*.

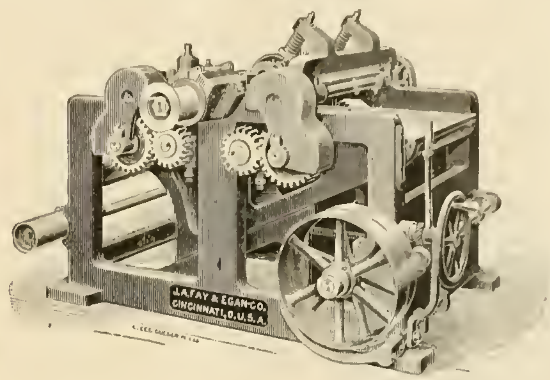
Dependable Hydraulic Jacks.

Unless a hydraulic jack is absolutely reliable, the engineer, mechanic, railroad man or whoever is using it, is better without it. Just at the critical moment, when everything depends on a jack "standing up," a poorly made device is liable to give way. The consequences are best left to the imagination, they are not pleasant, even to imagine. In the Watson-Stillman Hydraulic Jacks every such element of uncertainty is eliminated, hence the confidence reposed in them by those who have to trust life and limb to the dependability of a hydraulic jack. The cylinders and rams, for which, in some makes, so-called seamless tubing is thought good enough, are in the Watson-Stillman Jacks, forged from solid steel billets, forged and bored like the cylinder of a high-class steam engine. Valves, glands, pistons, etc., are made and finished with equal care, packings and other parts subject to wear are easily accessible and replaceable, the result being a hydraulic jack so thoroughly dependable and constantly ready for service, that it holds first place among this class of tools. The manufacturers, Watson-Stillman Co., 46 Dey street, New York, have a list of about 300 styles of hydraulic jacks, which they will send on request.

The Tennessee Central Railroad, which has been running under difficulties, is to be refinanced. Fifteen large freight locomotives are to be purchased this year and other new equipment. Grades are to be reduced, the roadbed improved and new stations and side tracks built. The road is located in one of the richest sections of Tennessee.

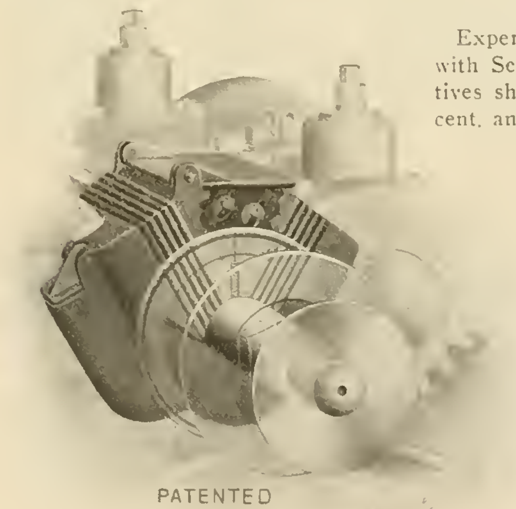
New Features on a Cabinet Planer.

Every operator of a planer is familiar with the trouble incident to removing the cutter head and re-babbitting and refitting the bearings. The accompanying illustration shows a device patented by the J. A. Fay & Egan Co., Cincinnati, Ohio, composed of two sets of thin babbitt metal plates, five to each set, whose



FAY & EGAN CO.'S IMPROVED CABINET PLANER.

edges rest upon the journals, and exert no pressure downward except their own weight. These plates are clamped into position and may be readily loosened for re-adjustment, entirely avoiding disturbing the cylinder or re-babbitting. The cabinet smoothing planer contains this admirable device besides other notable improvements, among which may be mentioned a new patent solid or sectional feed roll, a table moving on inclines, operated by parallel screws mounted on ball bearings. There is a



FAY & EGAN CO.'S IMPROVED BEARINGS, SHOWING BABBITT METAL PLATES.

solidity about these machines not common to planing machines, all the gears run on solid shafts instead of studs, and movable chip breakers rise with the circle of the knives. The company's new catalogue will be of particular interest to all who use planers or other wood working machinery.

The George H. Gibson Co., with offices in the Park Row Building, New York, has introduced a new method in engineering advertising. It is a well known fact that engineering products, no matter how admirable they may be, require an educational publicity campaign to bring them into popular notice. That there is a science of economy of communication and apprehension will be generally admitted. Every manufacturer is not prepared to establish expensive advertising departments of his own, and to meet this obvious necessity Mr. George Gibson, A. M., formerly manager of publicity for the International Steam Pump Co., and Mr. Halbert P. Gillette, M.E., formerly associate of *Engineering News*, have formed a partnership as advertising engineers and undertake to conduct advertising in the same manner as would a special department in the firm's own office. The idea is an excellent one and the success of the new venture is assured.

Experiments with oil-burning locomotives are being made on the Santa Fe system. If the experiments are successful it is said that all of the engines on the system will be equipped with oil-burning apparatus.

Experiments recently tried in Belgium with Schmidt superheaters on locomotives showed a saving of fuel of 30 per cent. and a saving in water consumption of 18 per cent. The expenses of lubrication were increased.

A slow watch is said to be the cause of the terrible collision that occurred between a passenger and a freight train near Vermilion, Ohio, last month. Charles W. Poole, the engineer of the passenger train, was killed, and twelve Italian laborers on the freight train were also killed.

A combination of street car builders is being formed including many of the largest concerns in the United States. The capital stock is placed at $54,500,000. The combination includes the Brill Company of Philadelphia, the Stephenson Company, the Peekham Company and the St. Louis Car Company, and many others.

Lakewood.

Lakewood is about sixty miles south of New York, on the branch of the Central Railroad of New Jersey, which runs to Bridgetown, Bivalve and Bay Side. One can have no idea unless from experience of the wonderful difference which exists between the air of the metropolis and that of the charming little pine encircled town. Lakewood has an invigorating atmosphere of its own and the change is pleasant to those accustomed to city life.

PICTURESQUE STATION ON THE C. R. R. OF N. J AT LAKEWOOD, N. J.

One of the attractions of Lakewood, and indeed one of the sights of this part of the country, is the residence of Mr. George Gould, with its immense stretch of beautifully laid out grounds. The estate is constantly open to the public and visitors may enjoy the broad walks and sunken garden to their heart's content. The principal attraction, however, is the fountain which is a work of art of rare beauty and worth. It represents a sea chariot drawn by two writhing sea horses. The chariot and the figure of the sea god are bronze and the horses and nymphs are marble. The whole is the work of J. Massey Rhind and was executed in 1902. Mr. Gould brought it to this country some years ago.

CENTRAL RAILROAD OF NEW JERSEY EXPRESS ENGINE ON NEW YORK AND LAKEWOOD EXPRESS TRAIN.

Oil Storage.

The Bowser Oil Storage Systems have reached a degree of perfection that seems to meet every imaginable requirement. Their outfits are adapted to parties who may be using but one kind of oil, or to those who may be using different kinds of oil in variable quantities. The company have just issued a new set of beautifully illustrated catalogues furnishing fine views and descriptive details of their various systems of storage from the ordinary tanks for lubricating oils to the underground storages where volatile and inflammable oils are stored. The self-measuring apparatus, the special long-distance outfits, the glass front oil cabinets, the fireproof cabinets are all described with a degree of minuteness that leaves nothing to be desired. The rapidly extending works on East Creighton avenue, Fort Wayne, Ind., is the best evidence of the great and growing popularity of their work.

The Crane Manufacturing Company, of Chicago, are constantly perfecting, and placing upon the market, something new in relation to valves. From an illustrated circular just issued we are pleased to call attention to a renewable spring disk readily renewable on globe, angle or cross valves. The disks used in these valves are made of metal instead of vulcanized rubber, which spreads under heat. The disk has a double bearing, is resilient and forms at all times a perfectly tight joint.

The Sprague Electric Company.

The Sprague Electric Company, of New York city, has perfected and placed on the market an electric winch of great strength and adaptability. It can be used in hauling cars or trucks into or out of shops, or dragging heavy material in any conceivable situation. Compact and readily removable it will pull from 12,000 pounds 25 ft. per minute to 2,000 pounds 150 ft. per minute. The gears are enclosed and protected by a heavy base.

The Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., have published a special circular in relation to their latest improvements in regulating and reversing controllers. The description and illustrations represent the highest development of electrical design and the most advanced methods of manufacture. They include equipments for the control of both alternating and direct-current motors under nearly all practical conditions.

The *Clarkson Bulletin*, a quarterly publication issued by the Thomas S. Clarkson Memorial School of Technology, at Potsdam, N. Y., contains a full report of the work of this admirable institution, besides an excellent essay, "The Engineer as an Economist," by C. J. H. Woodbury, A. M., of Boston. The Baccalaureate Address, by Henry DuBois Mulford, A. M., is also printed, and the *Bulletin* is altogether a tribute to the memory of a great public benefactor and a fine illustration of how well the noble institution founded by the late Thomas Clarkson is carrying on the good work for which it was designed.

FOUNTAIN IN THE GROUNDS OF MR. GEORGE GOULD'S ESTATE AT LAKEWOOD, N. J.

The Joseph Dixon Crucible Company, of Jersey City, N. J., have issued a descriptive circular calling attention to the merits of their wire rope lubricants. Extensive experiments have demonstrated the superiority of graphite as a lubricant for wire ropes. Dixon's Graphite Rope Dressing supplies the ideal qualities of grease and flake graphite to make it thoroughly acceptable to practical men.

The University of Chicago, founded by John D. Rockefeller, publishes a special announcement of evening courses in railway education in the Fine Arts Building, Chicago. The season begins on October 3, and the course is so comprehensive and the fees so insignificant that the opportunity should be embraced by every young man in Chicago interested in railway traffic, as well as by others who are not so young.

We have received a very elaborately illustrated catalogue from the Schaeffer & Budenberg Mfg. Co., of New York, which will be sent to anyone interested in their devices if application be made to the manufacturers. The catalogue contains illustrations of all the gauging and testing appliances connected with steam engineering that we are acquainted with, besides all permanent attachments such as oil cups, gauges, counters, calorimeters, etc. The company handles a kind of water gauge glass which they claim to be the best on the market.

Breaks the Record.

At the B. & O. shops at Washington, Ind., Mr. Charles Herr, a skilled machinist, is claimed to have broken the record in a test made in cutting cylinder packing rings. The castings were extra hard, involving considerable grinding of tools, of which, however, 48 rings, 20½ ins. in diameter by ⅜ in. by ¾ in., were cut in three hours and thirty-seven minutes. It may be added that Mr. Herr, who is an all-round mechanic, designed the pattern for the castings.

The Delaware & Lackawanna Railway Company are experimenting with an "electric-automied" block signal, which is declared to be practically infallible, and the man at the switch may have to go.

A heavy switching engine and a 100-foot steel cable pulled the roundhouse and fifteen other buildings to pieces in two days at Hartford, Conn. The grounds will be added to Bushnell Park adjoining the Capitol grounds.

Study and Utility.

A saying attributed to Prince Kung is that "the object of all study is utility, and its value must be judged by its adaptation to the wants of the times." That sentence contains very sound advice for those who are engaged in the strenuous railroad life. A man must study in some way or other if he is to progress, and what more natural than that he should seek to be well informed on matters which pertain to his chosen calling. He must study these things which, to put it plainly, it pays him to know, and we offer no apology for calling your attention to the list of books and publications which follow. The object of all of them is utility, and in any selection made you must determine the adaptability to your own wants.

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and children see it.

"Twentieth Century Locomotives," Angus Sinclair Co., deals comprehensively with the design, construction, repairing and operating of locomotives and railway machinery. First principles are explained. Steam and motive power is dealt with; workshop operations described, valve motion, care and management of locomotive boilers, operating locomotives, road repairs to engines, blows, pounds in simple and compound engines; how to calculate power, train resistance, resistances on grades, etc. Shop tools explained. Shop receipts, definitions of technical terms, tables, etc. Descriptions and dimensions of the various types of standard locomotives. The book is well and clearly illustrated and is thoroughly up to date in all particulars, fully indexed. Price, $3.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." Price $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. We sell it for 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. It sells for 75 cents.

The 1904 Air Brake Catechism. Conger. Convenient size, 202 pages, well illustrated. Up-to-date information concerning the whole air brake problem, in question and answer form. Instructs on the operation of the Westinghouse and the New York Air Brakes, and has a list of examination questions for enginemen and trainmen. Bound in cloth. Price, $1.00.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all abont running, breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a staionary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size, 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion, it is easily understood by every intelligent fireman. The price is 50 cents.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable, and, best of all, they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Standard Train Rules." This is the code of train rules prepared by the American Railway Association for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotive, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compounds locomotives. It is the real locomotive up to date. $2.50.

Railway and Locomotive Engineering. Bound volumes. $3.00.

Last month we had the pleasure of calling at the offices of the Pittsburgh Spring and Steel Company, and were very kindly received by the worthy president, Mr. D. C. Noble, who modestly stated that there was nothing particularly new about their work. The method of spring making, the material used, the multiplex forms which their work assumed, had been carried as near perfection as could be, and their only improvements or changes were mainly in the testing of springs. In every case certain high standards of excellence were maintained, and the rigidity, the flexibility, the resiliance of every spring was fully tested and nothing was allowed to pass that did not meet the required high degree of excellence. Those who are familiar with the variations of home made locomotive springs will be pleased to learn that it is cheaper and infinitely better to use the engine springs made by the Pittsburgh Spring and Steel Company. There is no end of trouble with home made springs, as is well known to all who have seen a locomotive settle low on one corner and marked the changing of spring hangers until the original measurements of hangers and equalizers were lost in a maze of confusion. Troubles begun in this way last with the life of the engine, and they can be readily avoided by using the springs of the Pittsburgh Spring and Steel Company.

It is gratifying to learn that the company's various manufactures are rapidly becoming popular in foreign countries as well as in America.

The Duff Manufacturing Company of Pittsburgh have just issued an elegant catalogue illustrating the use of the Barret jacks now in universal use all over the world. It is an unquestioned fact that the jack that Duff builds has all the strength of a hydraulic jack with rapidity of action and is particularly adapted for track, car and journal work. The uses to which these jacks may be put are endless, and in the event of any unimaginable contingency not being provided for, special jacks wil be made by the Duff Company to meet any special condition. Their simplicity of design, their durability of material, their absolute safety under every condition render the Duff jacks indispensable in railroad construction and repair. The gold medal of the Louisiana Purchase Exposition was unanimously awarded to the Duff Manufacturing Company for the excellence of the Duff jacks of all types.

The Cleveland Twist Drill Company have just issued a fine new catalogue illustrating their latest improvements in tools for turret lathes and screw machines. The work is a beautiful example of the engraver's and printer's art. We recommend its perusal to all who are interested in Turret lathe tools. An admirable method introduced by the company is the arranging of tools in sets. This is rapidly meeting with popular favor, and might be briefly explained by supposing that an article operated upon requires a 13/16 inch finished hole. The first tool necessary is a 25/32 inch twist drill, with or without oil tubes, then a chucking reamer, either spiral or straight, to follow the drill, and finally a finishing reamer of exactly 13/16 inch diameter. Their uniformity of size and adaptability save time and cost, and also insure perfect work. The company have been in existence over 30 years and their reputation is world wide.

Some interesting experiments have been made to ascertain which wood lasts the longest. It was found that birch and aspen decayed in three years, willow and chestnut in four years, maple and red beech in five years, and elm and ash in seven years. Oak, Scottish fir and Weymouth pine decayed to the depth of half an inch in seven years; larch and juniper were uninjured at the end of seven years. In situations so free from moisture that they may be practically called dry, the durability of timber is unlimited.

The Wabash System has just placed an order for fifteen locomotives of the consolidated type with the Baldwin Locomotive Company. They will be of the very latest pattern and cost $17,000 each.

Scenery in Maryland.

In the glow and glory of summer there are delightful views of picturesque scenery on all of the great railways; and on leaving New York it matters not whether we travel by the stately valley of the Hudson, or by the picturesque Delaware, or glide along by the leafy clad terraces of the Lehigh, or gaze on the sparkling waters of the Juniata, the vision that comes to us is full of beauty and sweetness.

In the heart of Maryland there is a combination of dizzy crags and woody wildernesses now rising into towering mountains and now stretching away into green and golden vistas. The head waters of the Chesapeake, clear as crystal, melodiously murmuring a quiet song, now flash in the happy sunlight and now linger and spread into still, motionless pools that reflect like a burnished mirror the blue sky and the green earth in all their brightness and beauty.

It may well and truly be said in passing that in the construction of the great roadway there is a degree of perfection that suits well the tourist seeking rest. The great engines with their elegantly equipped train of cars glide along the shining pathway smoothly and noiselessly, and the splendid panorama of hill and valley and forest and stream passes swiftly and silently before us, and revelations of nature in her beauty and her solitude come to us with the grace of a benediction, and the cares of the distant city become dim as dreams.

The new bulletin of the Cotton Furnace Company, of Newark, N. J., furnishes description and illustrations of an apparatus which is designed to effect a greater economy in burning fuel. It consists of a system of steam jet blowers and can be readily applied to all types of steam boilers. It is said to absolutely prevent black smoke, and the saving of fuel is undoubtedly a strong feature of its use, and will likely lead to wide popularity.

The Colean Manufacturing Company, of East Peoria, has started rebuilding locomotives for the railroads. The company reports that they are unable to turn out their work fast enough to meet the growing demand and will shortly enlarge their quarters.

The Ralston Steel Car Company has purchased over 100 acres of land in Columbus, Ohio, and work has been begun in the erection of extensive works. It is expected that when the works are in full operation, 25 cars a day will be manufactured there.

Air Brake Lubrication, with a description of the properties of Dixon's special air brake lubricants, is the subject of a handsome sixteen-page pamphlet by the Joseph Dixon Crucible Co., of Jersey City. As the fall approaches the proper lubrication of triple valves and other important brake attachments become a serious question. Professor Goss, of Purdue University, has made exhaustive tests on the subject, and is enthusiastic in his praise of Dixon's Graphite air brake and triple valve grease. It is impervious to climatic conditions, and needs to be applied not more than twice a year.

In anticipation of a large increase of southern travel next winter, several very large passenger engines of the Pacific type will be ready by October 1 for use on the Illinois Central. The road is being double tracked, and the portion between Bloomington and Decatur, Ill., is already completed.

The Lake Shore has received an order for the heaviest switch engines ever built by the Brooks Locomotive Works. They are all patterned after the "Dutch" engine. The links are outside the frames, and there is practically no machinery under the boilers.

The motive power of the Rock Island system is being increased this year by 115 engines, costing $2,500,000. The freight cars purchased this year number over 5,000 and cost over $4,000,000. All of the passenger equipment is of the highest standard.

It is reported that the Chicago & Northwestern have commenced operations with a view to building an extensive repair shop and roundhouse at Wausau, Wis.

The Lackawanna Railroad is ordering a large amount of new machinery for the shops at Buffalo, Scranton and Kingsland. Work will be proceeded with also in connection with the new terminal at Hoboken, N. J.

Fifty-five consolidation freight engines, twenty Atlantic type passenger engines and twenty-five switch engines have been ordered by the New York Central from the American Locomotive Company. Delivery on the order will start early this fall.

The Census Bureau has just issued a bulletin regarding the commercial value of the railroad property in the United States. It amounts to $11,244,852,000. Pennsylvania leads with $1,420,008,000. New York is about one-third less.

Cost of Trip to a Star.

"Let us suppose a railway to have been built between the earth and the fixed star Centaurus," said a lecturer, according to the *Philadelphia Bulletin*. "By a consideration of this railway's workings we can get some idea of the enormous distance that intervenes between Centaurus and us.

"Suppose that I should decide to take a trip on his new aerial line to the fixed star. I ask the ticket agent what the fare is, and he answers:

"'The fare is very low, sir. It is only a cent each hundred miles.'

"'And what at that rate will the through ticket one way cost?' I ask.

"'It will cost just $1,750,000,000,' he answers.

"I pay for my ticket and board the train. We set off at a tremendous rate.

"'How fast,' I ask the brakeman, 'are we going?'

"'Sixty miles an hour, sir,' says he, 'and it's a through train. There are no stoppages.'

"'We'll soon be there, won't we?' I resume.

"'We'll make good time, sir,' says the brakeman.

"'And when will we arrive?'

"'In just 48,663,000 years.'"

Self-praise is no recommendation.—*Bleak House*.

New Periodicals.

Among the new periodicals, "The Searchlight" is, perhaps, the most illuminating that has appeared in some time. It shines out every Saturday and presents a condensed, classified history of the Twentieth Century. An information library forms the basis of the work, and it is the largest collection of classified information of a general kind that is to be found in this city. Mr. E. G. Handy, who, it will be remembered, had charge of the Bureau of Publicity at the Chicago World's Fair, is president of the company. The publication office is at 24 and 26 Murray street, New York.

The Baldwin Locomotive Works are running day and night with a full capacity of 17,000 men, the largest they have ever had in their employ. The Pennsylvania Railroad heads the list of orders for locomotives, 200 being ordered last month.

It has been decided by the New York, New Haven & Hartford Railroad Company to spend $1,000,000 upon locomotive repair shops at Norwood, Mass., duplicating the large car repair shops at Readville.

Show me that man you honor. I know, by that symptom, better than by any other, what you are yourself.

Mechanical Engineering.

The Polytechnic Institute of Brooklyn has issued its annual prospectus calling attention to the course of instruction for the year 1905-6, in Transportation, Steam Engineering, Structural Design, Electricity and other branches of study, with laboratory practice and testing. This admirable institution has engaged the services of many of the most eminent engineers in their various branches of study, and the various classes which will commence in November bid fair to exceed in numbers the attendance of previous years. The fees are very moderate and the hours of attendance, from 7.30 P. M. to 9.30 P. M., ought to insure an attendance to the full capacity of the Institute. Mr. C. A. Green, the Registrar, will answer all inquiries addressed to the Polytechnic Institute, Brooklyn.

The New Nevada: The Era of Irrigation and the Day of Opportunity. This very interesting pamphlet, edited by A. J. Wells, and issued by the Southern Pacific Railway Company, gives a comprehensive view of the important improvements that are taking place in Nevada. The active work which is being done by the State and Federal Governments and by private enterprises in the way of reclamation of arid lands is being watched with general interest all over the country. Pictures and maps illustrate the work and the prospects seem to be of the most inviting kind. The work ought to be in the hands of every one interested in the development of the Far West, especially those looking for new homes.

Traveling Agent for the Canada Atlantic Railway Company.

In noticing in our August issue an excellent paper entitled "Practical Observations," read before the Canadian Railway Club, by Mr. W. S. Blyth, we fell into an error by stating that Mr. Blyth was traveling engineer of the Canadian Pacific Railway, whereas Mr. Blyth has been for several years and is still employed by the Canada Atlantic Railway Company, with headquarters at Ottawa, Ont.

The Ingersoll-Rand Company will take possession of its new offices on the fourteenth floor of the Bowling Green building, 11 Broadway, New York, on August 1. At that time the offices of the Ingersoll-Sergeant Drill Company at 26 Cortlandt street, and the Rand Drill Company at 128 Broadway, will be given up and the united forces moved to the new offices.

The Pittsburgh, Binghamton & Eastern Railroad propose building a new branch from Binghamton to Ansonia at a cost of $6,000,000. The shops will be located in Binghamton, and the official and leading men of the city and vicinity are much interested in the enterprise which will bring several hundred skilled workmen and their families to the city.

During September the delivery of 1,000 refrigerator cars will complete the number that have been manufactured at the Altoona car shops of the Pennsylvania Railroad. The order was one of the largest ever placed by the company with its own shops. The cars are of modern design, having air brakes and patent sliding doors. Their capacity is 90,000 lbs.

Rush orders have been placed with American firms by the Japanese Government with a view to equip extensive railway additions in Corea and Manchuria. The order includes 150 locomotives, 2,000 cars and 350 steel bridges.

A blue-book just issued in London, England, contains the report of the Royal Commission on locomotive transportation in London. The report recommends the construction of two main avenues about 40 feet wide for locomotive travel in London, at a cost of $120,000,000.

The Santa Fe Railroad Company has been experimenting with oil burning locomotives and so far with very satisfactory results. It is claimed that the Kansas oil is much superior to the California product. The change from coal burners to oil burning furnaces does not involve much expense.

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

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Terminal Station of the B. & O. at Baltimore, Md.

It would be well if all of our engineers and architects engaged in the planning and constructing of railway depots had as keen an eye to the beautiful in nature and architecture as the builders of the Baltimore & Ohio Railway Station in Baltimore had. To bring an unsightly depression into utility and beauty is a hard problem, but our frontispiece in this issue of RAILWAY AND LOCOMOTIVE ENGINEERING shows what has been accomplished at perhaps the most unpromising location in the beautiful Monumental City.

The passenger depot erected in the center of the hollow ground is of the Romanesque style, with ornamental Gothic windows, and surmounted by a central tower of commanding proportions. A wide asphalt roadway surrounds the building, and the sloping terraces approaching the higher ground are clad in all the verdant beauty of summer, interspersed with floral parterres glowing in rainbow hues.

When the numerous trees and shrubs have more nearly reached maturity the depot and its surroundings will be one of the most beautiful spots in the city, and the grounds, with their shaded pathways and flower-embroidered lawns, will undoubtedly become a popular resort, especially in the summer months. The people in the vicinity are already showing their hearty appreciation of the work of the railway company in creating a beautiful breathing space in the heart of one of the great residential sections of the city.

The result is alike a credit to the

AN OBJECT LESSON IN STATION IMPROVEMENT.

In the heart of a residence district of Baltimore. As the site of this station was formerly a refuse-strewn depression, the picture illustrates the practical as well as esthetic possibilities of the new movement.

builder and to the horticulturist, the consensus of popular opinion being that the landscape gardener has surpassed the architect, but both are to be commended for calling into being a place of utility and beauty out of the grosser elements of the earth.

Notes On British Railways.

How Circumstances Influenced Growth of Railways.

BY ANGUS SINCLAIR.

Glasgow, Scotland, Sept. 1, 1905.

A great many of the most important trunk lines in this country are composed of an agglomeration of small roads which were originally fanned into existence by the power of municipal subsidies and the combined assistance of rural communities ambitious of attaining increased facilities for the transportation of produce. The public highways in the United States never reached a degree of perfection that rendered the people oblivious to improved methods of intercommunication. Consequently, the first projects for connecting our cities and States by railroads seemed to meet with general favor; and the growth of the railroad system was as rapid and uniform as the resources of a comparatively poor country would permit.

OLD CONDITIONS OPPOSED TO RAILWAY INNOVATION.

In Great Britain the circumstances associated with the development of railways were very different. A system of statute roads, constructed at great public expense, extended from Land's End to John o' Groat's, radiating to every town and village of any consequence in the United Kingdom. Stage coaches traversed, with what then was considered amazing regularity, all the leading routes of travel; common carriers, with their heavy, lumbering wains, crawled daily from town to village, supplying merchandise to every rural parish, and waterways of canal, river or sea conveyed the more ponderous commerce between the larger cities. Behind these methods of transportation immense vested interests had grown up; and a recognized principle in the code of English morals is that no "vested interest" shall be disturbed without full compensation being made to the property which is going to suffer. The coaching system, besides its immediate employees, who were very numerous, had an immense army of satellites who were determined enemies of innovation. All the farmers and rustic squires, forming as they do the most acquisitive class in every community, felt assured that ruin would speedily overtake them should any interference be made with the staging business, which was popularly supposed to create and foster a demand for horses. Then there was the wayside inn. Romance has woven a delightful halo around these places of entertainment, where mine host of a jovial mien and obese form presided over a table loaded with the roast beef of Old England and garnished with pitchers of frothing ale or bottles of sparkling wine. Every parish had its inn with painted sign swinging before the door. There the dusty traveler stopped to quench his thirst, and there the youths of the neighborhood learned to empty the foaming tankard as they graduated upon the course of drunkenness, while clodhoppers from adjoining farms found sweet repose in the back parlor, with its sanded floor and rough benches, where on beer or cider they squandered the earnings which should have gone to support their wives and families. Although habits were developed by these country inns which stamped disgrace upon England and a curse upon Scotland, the people clung to what was considered a national institution with such unweaning fondness that any change threatening the prosperity of their public houses was certain to meet with unyielding opposition.

THE HIDEBOUND CONSERVATIVE BRITON.

When a new enterprise of any considerable magnitude is started in this country there is generally a disposition manifested among its promoters to indulge in spread-eagle talk about its magnificent future. People are quite as conceited and fully as sanguine over their plans in Britain, but the men who took the lead in introducing railways there had to talk very modestly about their projects, for had popular prejudice recognized the magnitude these iron roads were destined to assume, the battle of repression would have been fought more bitterly than it was. Some European journals are fond of ridiculing the Chinese for their apathy toward railway building, and for repudiating the small experimental line which was constructed there years ago, but few nations in Europe are less conservative than the Celestial Empire. The extension of the railway system in Europe has met with as much ignorant intolerance, it has been bled by as much unscrupulous cupidity, it has been opposed by as much bigotry, fanaticism and superstition as could be found in any part of the habitable globe. Its humble, unpretentious origin alone saved it from being blighted in the bud, and from small beginnings, like the cloud of old, no larger than a man's hand, it suddenly burst forth into an irrepressible power before its natural enemies had time to muster their forces.

ORIGIN OF RAILROADS.

The nucleus of our railway system, like the germ of the steam engine, was urged into active existence by the pressing force of necessity, and under closely parallel circumstances. For ages scientists had theorized over the possibility of using steam as a motive power; but the experimental machines constructed to illustrate their ideas were nothing better than toys, till a vehement demand arose for a force capable of draining water from deep mines, when a working blacksmith coupled the isolated machines of previous inventors, producing a train of mechanism which performed the work required. Valuable minerals are seldom found in immediate contact with the natural means of transportation, such as the sea, lakes, or navigable rivers. To convey coal and iron from the mines to such points in an inexpensive manner long taxed the ingenuity of mining proprietors, and led to the adoption of a crude form of tram road whereon wagon wheels moved more smoothly than they did on rut-cut highways. Mining industries were advancing rapidly when that improvement was introduced, for we do not require to go far backward into the history of the past to find the backs of horses the only carrying medium, a primitive means of transportation still used about some Spanish mines.

The idea of using longitudinal parallel rails for facilitating the movement of wagon wheels was no doubt first taken from lumber regions, where from time immemorial such rails have been used in a rough way to roll heavy logs on. During the seventeenth century nearly all the largest collieries in Great Britain had laid down wooden railroads for hauling their coal to the shipping places. As the wagon wheels readily abrased and wore out the timber, iron plates were gradually introduced and fastened to the parts most exposed to friction. The men employed to keep these roads in repair became known as plate-layers, a name still applied to the laborers who work on the track of English railways. So long as wooden or combination rails were used the track was constructed with a ledge to keep the smooth wheels from running off. The expense of timber led to the invention of cast-iron rails, which were laid on stone blocks, called "sleepers." Subsequently wrought-iron rails were found to be most economical, and with the adoption of iron ways the wagon wheels were made with flanges to keep them on the track.

The use of these crude, humble railroads gradually extended through all the mining districts. The wagons were dragged along slowly and laboriously by horses, every such road being an auxiliary to a canal or a feeder to a "staith," as the shipping stations were called. Two or three square boxes on four wheels, loaded with coal or iron, moving behind a horse at the rate of three miles an hour, was not an imposing spectacle, but it made the people familiar with that mode of locomotion and paved the way for introducing the most magnificent method of transportation the world has ever seen.

Powerful Ten-Wheel Freight Locomotives for the Lehigh Valley R. R. Company.

It is a noteworthy fact that nearly all of the recent improvements and modifications of locomotive engines have had their origin in America. Not only are the largest and heaviest engines being built here, but the increase in boiler pressure, the successful adaptation of the compounding of cylinders, the marked improvements in the details of construction, and the multiplication of the lesser mechanical appliances used on modern locomotives, nearly all have their origin and successful use in America.

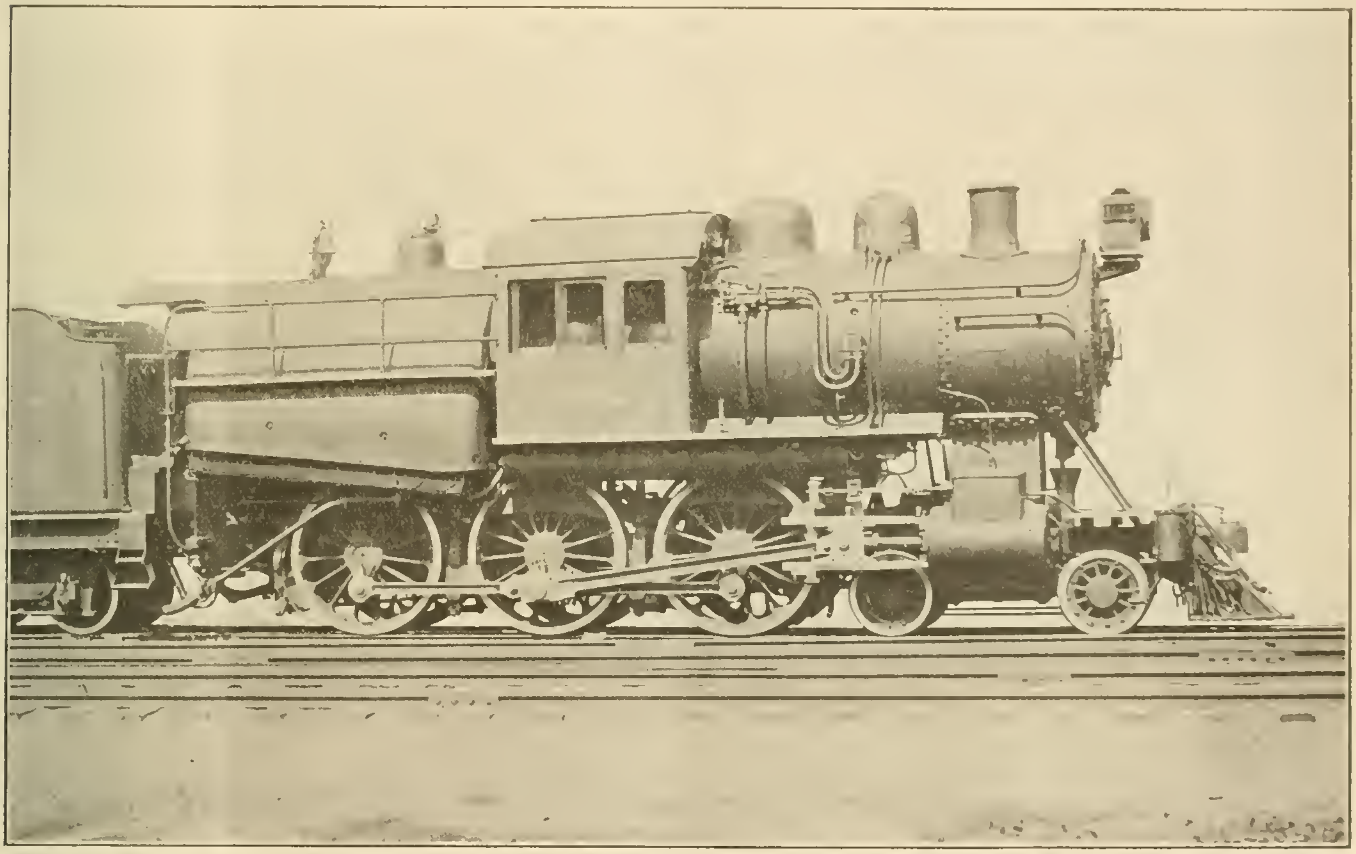
The accompanying illustration shows one of a large number of 4—6—0 freight locomotives recently delivered to the Lehigh Valley Railway Company from the Schenectady works of the American Locomotive Company. This type of engine, although not new, is being enlarged to an extent which is believed to be approaching the limit both in regard to size and amount of steam pressure used. The engines of this class were until quite recently used on switching and gravity yard work, but they are now used extensively on fast freight and passenger service, and have become a familiar feature on the various roads passing through the extensive coal fields of Pennsylvania.

As will be observed, the firebox is of the widest possible dimensions, extending over the frames with a width of 102 ins. by 120 ins. in length, making a grate surface of 85 sq. ft. This large area is well adapted for the use of anthracite pea or finer size coal. In the coal regions these engines get the name of "culm-burners" from the fact that the vast heaps of "culm," or refuse from the coal breakers, is now being extensively used as fuel for these engines, which indicates that in the course of time these unsightly accumulations of dross will be removed. The "culm" is washed and cleaned from slate and other impurities, and can be procured at an expense of less than one dollar per ton. The extensive firebox necessitates placing the engine-cab forward of the firebox, not so much for the purpose of making accommodation for the various levers and valves, but for the purpose of giving the engineer an opportunity to see the track, with its accompanying switches and signals. A footboard, with substantial hand-railing, forms a convenient gangway between the separated engineer and fireman.

The cylinders are outside the frames, and the connecting rods work upon crankpins on the intermediate pair of coupled wheels. The weight on the three coupled axles is advantageously distributed for giving great adhesive power to the engines. The front end of the engine is carried on a four-wheel truck which has an amount of lateral motion beyond the requirement of the sharpest curves.

The boiler is of very large dimensions, being of the straight-top style. The fine material and general bracing is adapted to a working pressure of 205 lbs., the thickness of the crownsheet being ⅜ in.; sides and back of the same material, the tube sheets being ½ in. in thickness. The side water spaces are 3½ ins. in width. The staying is of the radial type. The tubes are of charcoal iron, 378 in number, with a diameter of 2 ins. and 15 ft. 8 ins. in length. The diameter of the boiler at the front end is 70 ins.

The valves are of the Richardson balanced variety, with a travel of 5¾ ins., set with 1-32 in. lead in full gear, forward and backward. The cylinders are 21 ins. in diameter, with 28 ins. length of stroke. The total length of engine and tender is 57 ft. 1¼ ins., having a total weight of 351,100 lbs., the weight of the



TEN-WHEEL FREIGHT LOCOMOTIVE FOR THE LEHIGH VALLEY

A. E. Mitchell, Superintendent of Motive Power. American Locomotive Company, Builders.

engine alone being 199,200 lbs., the drivers having a weight distributed upon them of 150,200 lbs. The tractive power of the engine is 31,800 lbs., making the co-efficient of adhesion 4.7.

Some of the other dimensions of the locomotives are as follows: Wheels, outside tire, 68½ ins. in diameter; engine truck wheels, 33 ins. in diameter; tender truck wheels, 36 ins. in diameter; axle driving journals, main, 10 ins. x 12 ins., others 9½ ins. x 12 ins.; engine truck journals, 5½ ins. x 10½ ins.; piston rod diameter, 4 ins. with snap rings; smokestack, diameter 18 ins., above rail 15 ft. 2½ ins.

Buffalo & Susquehanna Dump Car.

The side dump coke car shown in our illustration was designed and built by the Pressed Steel Car Company to meet the demand of the coke carrying roads for a large capacity car of minimum weight. It is provided with a door arrangement which secures rapid discharge of load. A large number of these cars are now in operation, and they have been built to the following dimensions; Length over end sills, 41 ft. 9 ins.; length inside, 40 ft. 5 ins.; center to center of trucks, 32 ft. 1 in.; width of car inside, 9 ft. 7 ins.; height from top of rail to top of sides, 12 ft.

BUFFALO & SUSQUEHANNA SIDE DUMP CAR.

This gives a cubic capacity sufficient for 100,000 lbs. of coke, and with heavy arch bar trucks, having 5½x10 in. journals, and 700 lb. wheels, the total light weight is only a little over 47,000 lbs.

The surfaces of the sides and floor slopes present no obstruction to the free discharge of the load. The doors are of ample proportions, and are actuated by a simple and effective mechanism which is operated from one end of the car. The doors on each side at one end are controlled by an operating lever which has a pawl made to engage with the ratchet wheel on the outer end of the horizontal shaft. On the other end of this shaft is a double chain sheave to which the ends of the driving chain are anchored. The other ends of the chain are secured to a double sheave on one of the door shafts. Immediately behind this double sheave is a pair of toothed gears transmitting the motion simultaneously to both shafts. Keyed to both door shafts are bent lever arms to which the door links are connected. This arrangement gives a self-lock and eliminates any tendency to twist due to the weight of the load against the doors.

The doors are easily operated and several tests have been made with the cars after they have been hauled long distances with full loads of coke, and under severe weather conditions. In each instance the entire load has been discharged in less than thirty seconds without any manual labor other than that necessary for operating the doors.

In a test made on the Bessemer furnace trestle in Pittsburgh not long ago we learn from the report published in the *Press* that two cars were carefully timed and the results were very satisfactory. The account says: "They were loaded with about 95,000 pounds of coke. At a given signal unloading began. One-half of one car was unloaded in 25 seconds after the opening of the doors and the other side in 15 seconds. The time on the other car was about the same. Had both sides been operated simultaneously the car would have unloaded istelf automatically in 30 seconds or less.

"The cars are self-clearing, no poking or picking being necessary. The test was made to demonstrate the time that can be saved in unloading from cars of this type as compared with the old style cars."

Electrical Equipment at the Grand Central.

The electrical construction and equipment necessary for the great terminal at the Grand Central Terminal of the New York Central has been let to the General Electric Company, and it is expected that a portion of the work will be completed within a year. The terminal has practically a length of 35 miles on the Hudson Division and 25 miles on the Harlem Division of the New York Central. Within this territory, called the electric zone, arrangements are being made to move all trains by electricity. The plans call for the erection and equipment of two large power-houses and eight sub-stations. Each of the power-houses will have a capacity of 140,000 horse-power. The sub-stations will be used to transform the current from 11,000 volts to the working current of 600 volts.

Already 175 cars and 35 electric locomotives are in course of construction and will be in operation within a year. The cars will be of the multiple-unit type, each car being equipped with motors and being self-contained and independent. The electric locomotives must be used to handle the through trains from the place where the power is changed from steam to electricity into the city. It is expected that the change will be completed in about five years.

New Shops and Roundhouse for the Panhandle at Dennison, O.

Twenty acres of new railroad shops and yards, six miles of tracks, and the most modern equipment known, are the plans, and on the construction of which work has been begun, for the Panhandle Railroad at Dennison, Ohio.

The present shops were built in 1867, and are crowded together in a limited space wholly inadequate for the service. The new roundhouse will contain 74 stalls. The cost is estimated at $310,000. About 800 men are employed in the shops at present, but this number will be nearly doubled on completion of the new buildings and equipment.

The World's Locomotives. By Charles S. Lake, New York, Spon and Chamberlain, 380 pages, one volume, Octavo. Price, $4.00. This book, the work of a British author, will be of special interest to all who are interested in the numerous varieties of forms of structure in which the modern locomotive appears. The author has gathered from every country representative designs of locomotive building and over 300 illustrations with ample letterpress descriptions make the work an excellent compendium of the world's locomotives. There are also eight large folding plates giving details of the chief European designs of engines. The illustrations are excellent and the letterpress is a fine example of the printer's art. The work ought to be warmly welcomed by all who are interested in locomotive designing and construction.

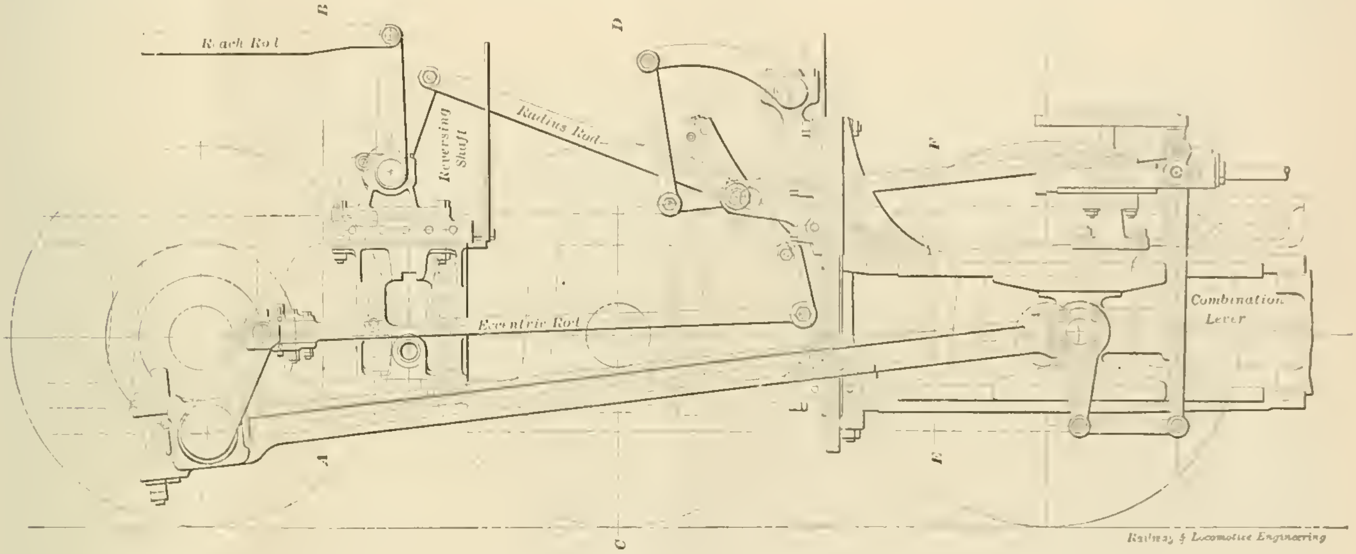
The Stephenson and Walschaert Valve Gears.

BY JAMES KENNEDY.

The increase in the size of locomotives, and the consequent need of stronger frame bracing, has made the adoption of a system of valve gearing that has its entire mechanism outside of the frames of the engine almost a physical necessity. If we add to this the fact that the fractures incident to the use of the so-called Stephenson valve gear are increasing, especially in the matter of eccentric straps, the wonder is that something has not been substituted before now in place of the cumbrous, complicated and always erratic system of valve gearing. It will be admitted that eccentrics depending for their motion on the driving axles with their incessant vertical vibrations, the eccentric-rods in turn transmitting their sharply angular and, consequently, irregular motion to the radial link which lends itself to lapses in motion incident to its long angle and resultant slip of the link block; and in turn conveying its increased system of variations to the valve-rod, finally convey a motion to the valve the exact varying velocity of which is past finding out. The number of divergent joints through which the motion has passed before reaching the valves are of such a complex kind that even if we should omit what might be allowed for the wear and tear of main and connecting rods, it is not to be expected that the valve openings can be maintained at the same relation to the stroke of the piston for any considerable length of time. Valves carefully adjusted with a certain amount of opening at the end of the piston stroke will be found in a few days to have closed altogether, or possibly to have doubled the amount of opening. There is perhaps some consolation in knowing that they are somewhere thereabout, although a close investigation will show that whatever is lost or gained at one end of the stroke is more than doubled in error at the other end. A careful adjustment under such conditions seems hardly worth while, if it were not that the slightest visible lapse from the proper position invariably rapidly increases in magnitude. In locomotives, when the eccentrics are attached to the main driving axles, the conditions are not so deplorable as is the case where the eccentrics are attached to another rod-connected pair of drivers. Their loose joints seem to lend themselves willingly to the multiplication of error. So common is this that the variable exhaust, giving vehement vocal utterance to the sad story of variable volume and irregular time, falls upon inattentive ears. The Stephenson valve gear has one advantage which seems to make up for a multitude of shortcomings—it opens rapidly at or about the time that the steam is required. It was a kind of happy coincidence, entirely outside of the range of human invention, that while the piston had, comparatively speaking, only begun to move slowly, the valve was moving rapidly, admitting the full pressure of steam at the time when it was needed. When running with a short stroke of the valve this accomplishment is overdone, an opening sometimes approaching three-eighths of an inch occurring before the piston has begun its return stroke. The loss of power incident to the irregularities of the ordinary slide valve would be difficult to calculate, and if calculated would be still more difficult to believe, and if believed would be infinitely most difficult to amend; but the introduction of the Walschaert valve gear, and the apparent determination to give it a fair trial, gives promise that perhaps a change for the better in the matter of valve gearing is approaching.

As pointed out in an able article published in RAILWAY AND LOCOMOTIVE ENGINEERING last December, the Walschaert valve gearing has long been popular in France and Germany, and is standard in the Belgian State Railways. Within the last year the leading locomotive works in America have all turned out a number of locomotives equipped with this particular form of valve motion.

As will be seen in the accompanying drawing kindly furnished by Theo. N. Ely, Chief of Motive Power, Pennsylvania R. R. Company, the Walschaert valve gearing combines two motions, one from a crank-arm which is attached to the main crank-pin and has its center at a distance from the center of the axle almost equal to the distance of the extreme travel of the valve. This crank-arm is equivalent to an eccentric, and its relation to the driving crank is nearly the same as in the ordinary valve gear. While the driving crank travels around a circle measuring 24 ins. or 26 ins. in diameter, according to the length of stroke, the path of the crank-arm to which the eccentric is attached is an inner circle of 10 ins. in diameter or whatever the extreme travel of the valve necessitates, the adjustment of the two cranks being at right angles to each other, instead of being about 85 deg. before and after the driving crank, as is usual with double eccentrics in ordinary slide valves. The link is pivoted on a central fixed point, and oscillates freely on this point. A radius rod carries the link block, and the block is moved up and down in the link by an extension of the radius rod to a sufficient distance beyond the link to allow an intervening connection engaging the reversing shaft arm. The radius arm is attached at its other extremity to the combination lever, which in turn is engaged by an



THE WALSCHAERT VALVE GEAR.

intervening union bar to an arm firmly attached to the crosshead. The effect of these two separate motions is that the eccentric and radius rods operated through the radial link determines the amount of travel of the valve, while the attachment to the crosshead has the effect of producing a fixed relationship to the motion of the crosshead. The amount of the opening of the valve at the end of the stroke of the piston becomes a fixed quantity not subject to variations in valve travel. The valve rod attached to the valve crosshead is double-nutted outside and inside the valve crosshead, and any variation arising from the slight amount of lost motion can readily be rectified by the adjustable nuts on the valve rod.

The apparent advantages of the Walschaert valve gearing are primarily in the elements of simplicity and readiness with which the parts may be got at. These alone ought to recommend it to questioned. Opinion has grown, as error is apt to grow, that an admission of steam is absolutely necessary to create a cushion upon which the piston and connections may gradually come to rest before beginning the return stroke. Those who are accustomed with the running of locomotives know that when the throttle valve is closed the rods and reciprocating parts run smoothly, even if loose. No pounding is observable at any rate of speed. Is it not reasonable to expect that the piston meeting with steam resistance before it has completed its stroke should rudely affect the bearings of the rods and crank-pins and induce an excess of friction? It has been repeatedly shown that if the pre-admission of steam amounts to a sufficient quantity to cause compression, a marked increase in steam consumption is shown. The loss is owing to what may be called the anticipatory condensation of the steam as its pressure and

VIEW OF ZAMBESI GORGE AND BRIDGE JUST AFTER LINKING TOGETHER OF THE TWO HALVES.

American locomotive builders as a welcome change from the heavy link gears with which the larger engines have necessarily been equipped. There are other advantages, as in the constant relation which the valve has to the movement of the piston in the cylinder. In consequence of this, the acceleration or retardation of the piston motion is immediately accompanied by like effect in that of the valve, thereby diminishing the irregularities incident to the angular advance of eccentric rods in the ordinary valve motion. The Walschaert radial link also, not being influenced by a double system of eccentrics, does not oscillate through so large a space as the ordinary link. The result is that the Walschaert gear does not spring the motion as much as the Stephenson link does when at or near the end of the stroke.

The advantages of a constant amount of lead for all degrees of cut-off may be temperature rise during compression. The real need is the readiness of admission of steam at the time when it is required to move the piston in the other direction, and while the ordinary valve has this advantage in a marked degree, this rapidity of opening compensates in some degree for its other defects.

Assuming, however, that lead is desirable for slightly cushioning the piston while the working parts of the engine are being subjected to intense friction, is it not reasonable to assume that the same amount would be sufficient for different rates of speed? Upon what hypothesis can it be assumed that one-thirty-second of an inch is sufficient opening at a moderate rate of speed and that three-eighths of an inch is necessary at a higher speed?

It will be found in the Walschaert valve gearing that the direct and accurate transmission of the crosshead motion to the valve, and its consequent continued exact relation to the piston is its most important advantage. A series of experiments in the Prussian State Railways has shown that the action of the Walschaert valve can be readily affected by the shortening and lengthening of the rods and connections, and that the best results are obtained when the movement of the crosshead is transmitted as exactly as possible to the valve. As in setting the ordinary valve, the best position can readily be found by trial, two or three points usually giving the required solution.

It may be added that in compound locomotives when the increase of lead caused by shortening the travel of the valve necessitating large spaces for the unavoidable compression of steam, may be avoided by the use of the Walschaert gear. The average weight of the parts in the larger compound engines is about 1,250 lbs., the Stephenson valve gear in the same class of engine weighing about 2,750 lbs. This larger weight moved and reversed for every revolution imposes great friction on the eccentrics, and consequent breakages of the straps are unavoidable.

In closing it may be said that the ordinary valve gear, although named after Robert Stephenson, the eminent British engineer, was not invented by him. Two workmen employed in his shops at Newcastle, England, claimed the invention. The proof seemed to be in favor of a Welshman named Williams. The reversible quality of the radial link when fitted with double eccentrics was claimed as the invention of Mr. Carmichael, a Scottish engineer. Mr. Stephenson introduced the mechanism to public utility, as he did the locomotive. The Walschaert valve gear was originally developed by E. Walschaert in Belgium in 1844.

An Old-Timer.

"The first and only home-made engine used on the old Hannibal & St. Joseph line was built in the shops in Hannibal about the time the name of General U. S. Grant was shaking the American continent," says Benjamin Smiley, a veteran mechanic and railroad man of Marion county.

"Every part of the U. S. Grant was made in our shops. I worked on the cylinders. The connecting rods were laid in a box containing a composition, one of the ingredients being rosin, and then placed in a furnace for a day. Then, while yet under tremendous heat, the rods were drawn and plunged into a bath of cold water. This was the tempering process then.

"The U. S. Grant was a good machine. It was the king of our motive power then. It had a large, balloon stack and was arranged to burn either coal or wood."

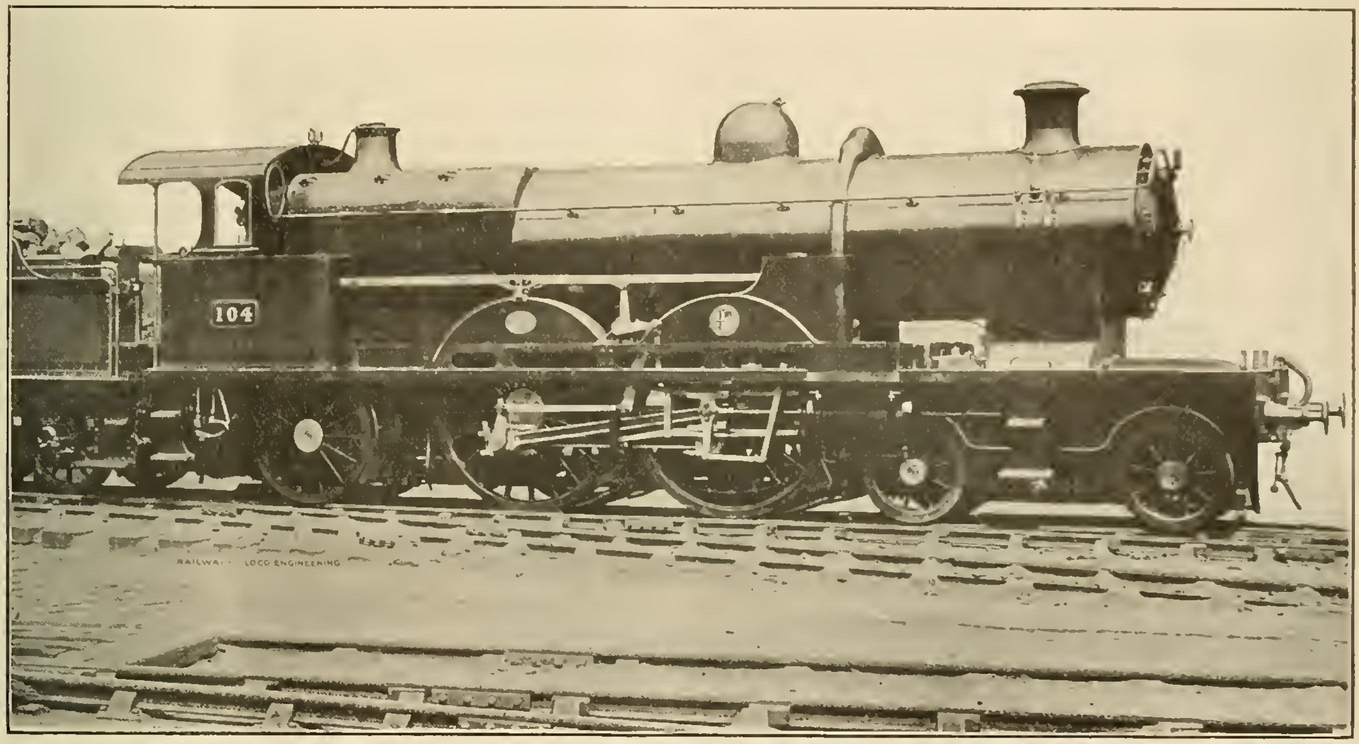
New De Glehn Compound Locomotive for the Great Western Railway of England.

We take pleasure in reproducing an illustration kindly furnished to us by the Great Western Railway Company of England of their latest form of compound express locomotives. The company has shown marked enterprise in their repeated and careful experiments with different forms of locomotives for their express service. The present illustration is a view of the improved compounds that are being furnished by the Societe Alsacienne de Constructions Mecaniques, and combines the features of strength and elegance in a marked degree. As will be seen, the engineer's cab approaches more nearly to the general form used on American locomotives than the regular British open-air method of housing so long in vogue. The high-pressure cylinders are not seen in the illustration, but their pistons are connected with the front driving axles, and the placing of the cranks and counterweights make a perfectly balanced and powerful combination. The great length of frames and the rigidity of construction would render these engines liable to fracture if used on the sharp curves of American railways, but on the long, level stretches of the Western Railway of England they ought to be able to give a good account of themselves.

We understand that the French manufacturers are much pleased at having an opportunity to compete with the British locomotive builders, and the records of the new engines will be watched with much interest.

As is shown in the illustration, the engines are furnished with the Walschaert valve motion, which is not only simpler and lighter than the ordinary valve gearing, but also allows of a much more substantial method of frame bracing than is otherwise possible. These engines are the strongest now in use on the Great Western, and surpass both in dimensions and in steam pressure those which were added to their equipment in 1903.

The following are some of their dimensions: Diameter of high-pressure cylinders, 14 3-16 ins.; diameter of low-pressure cylinders, 23⅝ ins.; stroke of all cylinders, 25 3-16 ins.; diameter of coupled wheels, 6 ft. 8½ ins.; diameter of trailing wheels, 4 ft. 7⅞ ins.; diameter of bogie wheels, 3 ft. 2 ins.; total length over buffers, 38 ft.; heating surface of boiler, 2,616.8 sq. ft.; area of grate surface, 33.9 sq. ft.; center of boiler above rails, 8 ft. 10 5-16 ins.; working pressure per square inch, 227; weight of engine, 73 tons 6 cwt.; weight on driving wheels, 39 tons; weight on bogie wheels, 10 tons; weight on trailers, 15 tons 6 cwt.



4-4-2 FOR THE GREAT WESTERN RAILWAY OF ENGLAND.

Carbon a Life Creator.

Most of our readers are familiar with the manifestations of carbon that produce heat and combustion. Some of the scientists who are investigating the origin of life now attribute a new power to the element carbon. They insist that it possesses the power of linking its atoms together in very large and complex groups, and that these groups are able to assimilate the molecules of certain other atoms. The larger these loose, mobile groups grow, the more power they acquire. So long as their structure is not dissolved by too great a heat, or solidified by intense cold, they become the vehicle for influencing minute cells, which acquire a power wholly novel and unexpected.

The complexes group themselves into minute cells, which acquire the power of uniting with other cells. They absorb into their own substance such portions as may be suitable, and exclude the less organic portions. Thus, then, begins the act of "feeding." A cell which grows by assimilation need not remain entire, but may split up into two or more new cells. Thus begins the act of "reproduction."

The Montreal works of the American Locomotive Company have received large orders for locomotives from the Grand Trunk Pacific Railway Company. The construction of this transcontinental line began last month and will be pushed with great rapidity.

A new feature has been added to the "Twentieth Century" and "Lake Shore" limited trains. Passengers can communicate by telephone with their homes or places of business until the departure of the train. No charge is made for the telephone service.

At the New Railroad Shops of the D., L. and W. at Kingsland, N. J.

The Delaware, Lackawanna & Western Railroad Company are making great changes at Kingsland, N. J., and when you drop off at the neat little depot and proceed over the red sandstone hillocks to the railroad shops you can see that there is something doing. A colossal chimney stack seems reaching for the clouds, with multitudinous bands of iron encircling it, reminding us of pictures of the Tower of Babel. When you get to the summit of the last red hillock, and gaze, like Moses of old, on the promised land, a wonderful panorama spreads before you. The extensive new buildings, which, when finished, will cover fourteen acres, are more than half completed. The car shops, 700 ft. in length by 168 ft. in width, are finished, with the exception of the flooring. The building is divided into five compartments, for stripping, repairing, constructing, rebuilding, and painting the cars. Adjacent to this is the storeroom, 80 ft. by 160 ft., already completed and assuming a carefully classified completeness of arrangement that leaves nothing to be desired. A building of similar dimensions adjoins for the storage of paint, with an underground fireproof storage for volatile and inflammable oils.

The flooring of the great buildings, on which a large number of men are at work, looks as if it was intended to last forever. Over the solid rock on which the various structures are entirely built there is placed about 15 ins. of concrete: then, over it, on a facing of fine sand, bricks are laid with an arched elevation of 1½ ins. in the centre of each space between the tracks, the bricks being finished with asphalt.

Between the car shop and storerooms there are glass-covered ways, so that there is no need of exposure to the employees who may have occasion to pass from one building to another. The roofs are of concrete, intersected with expanded metal, stretched on braces of steel, with great central skylights.

Outside the transfer table, moved by a 40-h.p. electric motor, traverses a track 70 ft. wide by 766 ft. in length. The largest engine and tender together will have about 20 ft. to spare on this table, so that provision is made for the larger engines that the twentieth century is sure to bring forth.

On the other side of the transfer tracks, on the ground where the machine shops are to be located, there is at present a steam shovel scooping a hill to the level of the surrounding country. The red sandstone is crushed and baked into bricks and used on the floor work. At one extremity of the partially completed buildings the power house is already completed, 90 ft. in width by 160 ft. in length. Arrangements are being made for the 15,000 h.p. engines, with room for more when necessary, not to speak of the dynamos, pumps, and other engines.

A water tank also is in course of construction, 150 ft. in height, with a capacity of 100,000 gals. In the boiler room six boilers are being arranged for at present, with a capacity of 300 h.p. each. The arrangements for moving the coal and ashes preclude any manual labor—electricity moving the coal into place and removing the ashes that fall into cars under the furnaces.

Mr. J. S. Pratt, the general foreman, took us through the works and took pains to explain to us many of the new features that will be found in the completed shops. The old machine shops are crowded beyond their capacity, and the staff of 350 skilled workmen will be more than doubled when the new shops are completed, which will be in about another year. Meanwhile machines of the most approved modern type are being ordered from the leading makers, and it may be added that the plans thus far approved embrace an outlay of over one and a half millions of dollars, and probably by the time that the work is completed no less than two millions will have been expended in the construction of the new repair shops of the D., L. & W. at Kingsland, N. J.

Testing Locomotive Boilers.

At the September meeting of the Central Railway Club, held in the club rooms at Buffalo, N. Y., the chief subject was an original paper by Mr. George Wagstaff on the question as to whether hydrostatic tests of locomotive boilers were necessary. Mr. Wagstaff spoke in favor of the water tests, and in the course of his remarks said:

"The only means we have of ascertaining with any degree of certainty the safety of a boiler is by the application of pressure, which should be under conditions as similar as practicable to those of actual work. Let a boiler be ever so carefully designed and constructed according to the best knowledge acquired by careful research and long experience in the strength and disposition of its materials, and let every plate be tested before it is put in, there will still remain an element of doubt as to the actual strength of the boiler, since the material may have sustained injuries in the process of construction which may have escaped detection. In the case of a new boiler, even by a first-class maker, to say nothing of original and hidden flaws in the plates, bars, angle irons and castings, there is always a possibility of defects such as bad welding, careless riveting, plates burnt in flanging or cracked in bending, and many other defects that may be traced to the want of skill or reckless negligence on the part of the workman.

"The locomotive boiler does not admit of anything like proper examination. The expense of removing the tubes alone would forbid a periodical examination of the shell of boiler, and the water spaces around fire box are almost entirely out of sight; consequently a thorough examination is out of the question. In all cases there is only one means of testing the strength of the boiler, and that is—the application of pressure.

"That the hydrostatic test is a very convenient method of testing the tightness of the work on a new boiler cannot be gainsaid, and hence its almost universal adoption, in conjunction with inspection to a greater or lesser degree, in the passing of new work. As a detector of leakages it has at least no rival, and its application enables faulty caulking to be made good before the boiler has left the works, and before a leak has time to enter on its insidious career of corrosion. It will be evident that if the test be applied with this object to a new boiler, the pressure should range to some point in excess of the working load if such a test is to be of any practical value."

Extensive additions will be made to the Kansas City Southern repair shops. Plans for the new buildings embrace a monster new machine shop, and a thirty stall roundhouse. The machines will be of the newest design.

The Rock Island has done much to facilitate western mail service. It has just adopted what is known as the Burr Delivering device, whereby mail bags are caught or delivered at full speed without injury to the pouch.

The "Daniel Nason" locomotive, which was exhibited at Chicago in 1893, has been added to the extensive collection of curios at Purdue University. The type was common in the Eastern States about fifty years ago.

Three thousand coal cars will be added to the equipment of the Wabash. They have at present nearly 7,000 cars. The new cars will be used chiefly to relieve the Pittsburg district.

The Western Maryland Railroad Company has equipped the repair shops at Hagerstown, Md., with a large number of new machines, and have commenced building twelve new locomotives. The rapid increase of traffic during the year has necessitated an increase of equipment and an extension of the repair shops will be begun at an early date.

Prevention of Rust.

Some particulars have been forwarded to us of what is stated to be a new and valuable material discovered by Dr. Henry Arzt, of Vienna, which is claimed to possess the singular property of permeating any substance to which it may be applied, with results which are alleged to be of a beneficial character to the substances so treated. For instance, it is asserted that a soaking for 30 minutes in the material referred to, which is called "Zorene," of steel, iron or other metals will confer on them the power of resisting oxidization, and this not by interposing a coating like that of varnish between the surface of the metal and the oxidizing influences, but, as it is asserted, by the actual absorption of the "Zorene" into the body of the substance so treated. The liquid is claimed not only to prevent the oxidation of metals, but also the decay of wood, ropes and canvas through damp, while it renders clay, stone or brick practically waterproof, greatly increasing at the same time the density of the material. It is alleged that the discoverer has received many applications to treat all sorts of materials by his process, and that many of these applications have proceeded from a number of railway companies and large engineering firms. Although it is manifestly impossible to form a definite judgment of the value of the treatment until time has proved whether it is as efficacious in the prevention of oxidation as it is represented to be, some scepticism may be reasonably expressed concerning the broad claims made in its behalf, which appear to include the prevention of dust on highways, in addition to its non-oxidizing qualities. The demonstrations given publicly of the material do not appear to have been very conclusive.

The Quality of Staybolts.

On September 15th the members of the New York Railroad Club began the series of fall and winter meetings. The attendance was large, and after disposing of the regular routine business an able paper was read by Mr. John Livingstone on "The Quality and Utility of Solid, Flexible and Hollow Staybolts, in Iron and Copper." Mr. Livingstone spoke very forcibly in favor of charcoal iron as the best metal for use in staybolts. He claimed that, however worked, coal-smelted iron is not equal to iron smelted and worked from charcoal. That was the fuel of England for iron for high-class forgings, until Great Britain was deforested. That continued to be the kind of iron (obtained from Norway or Sweden) for high-class forgings, making them from Swedish scrap, by which an erroneous opinion became prevalent that iron made from scrap was bettered, whereas the betterment in those high-class forgings was in the fact that the Norway or Swedish scrap was all clean and chemically pure, made from the magnetic ores of those countries, smelted and worked with the charcoal also made in those countries.

Norway and Swedish iron is, however, too porous, as received in importations, for staybolts. It requires to be worked and reworked, preferably in with other charcoal iron; its reworkings make it less porous, more dense and cohesive, and more suitable for staybolts.

The gain to the locomotive in reworkings of coal-smelted iron and the greater gains to the locomotive in reworkings of iron with charcoal for fuel will be understood by reference to tests which took place in Great Britain some years ago, preserved in Byrne's Publication. Before the forging implements were perfected as now, and when the British Government was troubled with bursting guns, as the railway men are now troubled with breaking staybolts, twelve tests were made to discover betterments obtainable from reworkings, viz.:

Tests 1 and 2: Were samples of once rolled iron from the puddled bars. Average tensile strength 49,504

Tests 3 and 4 and 5: Were samples cut from across the grain of the gun. Average tensile strength 43,390

Tests 6 and 7 and 8: Were samples cut with the grain from the gun. Average tensile strength..50 624

Tests 9 and 10: Were borings from the gun, worked over with coal for fuel. Average tensile..61,704

Test 11: Was borings from the gun worked over with charcoal for fuel. Tensile strength in pounds, per square inch.......76,584

Test 12: Swedish bar iron, as imported. Tensile strength.......60,584

Steam Railway Motor Cars for Austria.

The Imperial Austrian Railway administration have recently introduced a number of motor cars of the type known as the Komarek system. The boiler is of the water tube pattern. There are two cylinders working compound with diameters of 9¾ ins. and 15¼ ins., with a stroke of 15¾ ins. The driving wheels have a diameter of 39½ ins. The engine is about 150 h.p., with a speed of 20 miles per hour. The weight of the car, empty, is about 20 tons. It is divided into a luggage compartment, a section to seat 8 non-smokers, and a larger section to seat 30 smokers. Herr Golsdorf, an eminent Austrian engineer, has fitted the engines with a new type of valve gear, consisting of a combination of simple levers without the usual radial link.

AUSTRIAN STEAM RAILWAY MOTOR CAR.

The Missouri, Kansas & Texas Railway Company has just issued their annual report showing gross earnings from July 1, 1904, to July 1, 1905, amounting to $20 041,095, an increase of 15 per cent. over the previous year's earnings. After paying operating expenses the net receipts amount to $5,103,375. After paying interest on bonds and rentals a surplus of $1,267,190 remains. The mileage now in operation is 3,043 miles. The ratio of expenses to earnings approaches 75 per cent. The prospects are excellent.

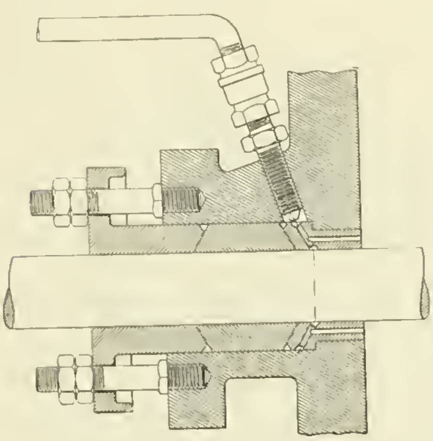
The oldest lighthouse now in use is believed to be that at Corunna, Spain It was erected in the first century of the Christian era, and rebuilt in 1634

Patent Office Department.

It is our aim in this department of Railway and Locomotive Engineering to call special attention to improvements that are specially constructed with a view for adaptation to locomotives or railway rolling stock. Our descriptions of these patented devices are necessarily short, because it is desirous to present as many of these inventions from month to month as our space will permit. It is our purpose also to present some of the illustrations to accompany the description, and, in brief, to make this department a reflex of the best work of the inventive minds of the present time in relation to the important work to which this publication is devoted.

OIL-CONDUCTOR.

A patent has been granted to Carl B. Wenner, Boston, Mass., for a device for conducting oil to piston rods and engine cylinders. As shown in the accompanying illustration, the oil is conducted inside the piston packing, where a hollow bushing provided with an annular channel in its outer and inner peripheries, the channels being connected by a series of transverse oil passages and with passages to the end of the bushing, thereby supplying the oil to the piston rod throughout its entire periphery, the oil being also drawn into and distributed throughout the cylinder. The device has been thoroughly tested and approved of at the shops of the Boston & Albany Railroad, at Boston, Mass.



WENNER'S OIL CONDUCTOR.

SCALE IN BOILERS.

Lancelet W. Thompson, Hobart Mills, Cal., has secured a patent for a composition of matter removing scales from steam boilers. It consists in quantities to the gallon of four and one-fourth pounds of potatoes, three pounds of brown sugar, and one quart of kerosene. It is said to be an excellent preventive of the formation of scale.

LUBRICATOR.

A lubricator having a pair of pumps of unequal capacity having reciprocating plungers, a bar providing a rigid connection between the plungers constantly maintaining a supply of oil for and to the full capacity of the pump of lesser capacity, has been patented by Ivar A. Randell, Chicago, Ill. The lubricator insures a positive feed.

OIL-CUP.

A patent has been granted to Howard B. Sherman, Battle Creek, Mich., for an improved oil-cup having a central tubular spindle projecting through the top-plate of the cup and exteriorally threaded, a scutcheon pivoted around the end of the spindle and closing the opening in the top plate, a regulating valve having its stem projecting above the spindle with an adjusting head. A locking-finger engages the head and yieldingly locks the stem and scutcheon together. The device is simple and reliable.

SANDING DEVICE.

A sanding device has been invented and patented by Charles Thompson, Philadelphia, Pa., comprising a reservoir with valve seat, a pressure cylinder, an internally threaded piston under spring tension fitted to the cylinder, a follower with valve-stem and valve and stop to limit the movement of the valve. Agitator-blades are attached between the stop and valve. The sand opening is readily kept clear.

CAR-COUPLING.

Edwin C. Washburn, Minneapolis, Minn., has secured a patent for a car-coupling device. The claims embrace a coupler-head, a pivoted knuckle and a lock-dog, the head having transversely extended upper and lower buffer-webs, the knuckle being tapered at the projecting portion so that the knuckle of one coupler readily enters the buffer-webs of another coupler.

STEAM-BOILER FURNACE.

John J. Le Duc, Mankata, Minn., has invented and patented a steam-boiler furnace containing a hollow flame-sheet located within the fire box and in communication at opposite ends with the water-space surrounding the fire box. Attachments are made to blow off the hollow flame-sheet. Water tubes extend between two series of headers, each header being provided with an inlet and an outlet. A steam and water-tight ball and socket connection is made between the water tube and the crown-sheet. The effect is to greatly increase the heating surface in the fire box.

DUMP-CAR.

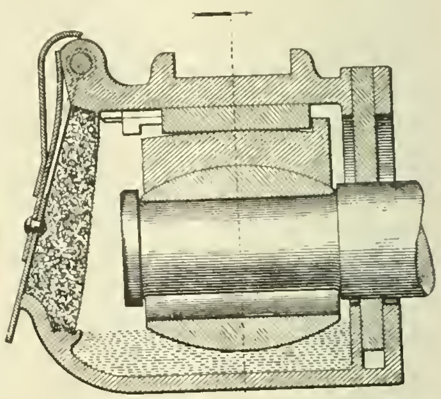
A dump-car has been patented by John S. Stevenson, Detroit, Mich., which comprises a supporting frame including side sills, and of tilting sections pivotally mounted upon the frame, the tilting sections having discharge openings at their inner ends, and means extending transversely for closing the discharge openings when the tilting sections are in normal position.

ENGINE-VALVE MECHANISM.

Ezra G. Moore, Silsbee, Tex., has invented and patented a valve motion suitable for locomotives, the mechanism being mounted on the driver axles with a separate link mechanism connected to each valve, the connection between the link and valve taking the form of a longitudinally-reciprocating bar having an offset and motion-transmitting mechanism extending from the valve and slidably connected to the bar.

JOURNAL-BOX.

Spencer Otis, Chicago, Ill., has invented and patented an improved journal-box, as shown in the illustration, the chief feature of which is a non-rotatable bearing, and a bearing ring, having a smooth bearing surface encircling the journal and curved longitudinally of the journal, such ring permitting the oscillation of the opposite ends of the journal with relation to the non-rotatable bearing; the movable ring being the only point of support of the journal box, gives a flexibility particularly adaptable to railway curves.



OTIS' JOURNAL BOX.

HOSE-COUPLING.

A hose-coupling device has been patented by August J. Itrich and William F. J. Lutz, Chicago, Ill., the coupling of one part having a head of increased diameter with an annular channel in its engaging face, providing with a packing in its innermost end and a shell forming the inner boundary of the channel and having a series of grooves in its circumference with springs therein having inturned hooks, the other end of the coupling having a flange adapted to be engaged by the hooks, the effect being to compress the packing. An adjustable ring moves the hooks to release the flange.

General Correspondence.

An Idea on Crankpins.

Editor:

Enclosed find sketch of Mr. McAttee's improved crankpin. Some years ago an idea prevailed on a number of railroads that to do away with the constant wear on the crankpin the pin could be case-hardened. This was tried and would have worked very well, but the pins would sag in the center while being hardened and come out bent.

When put on the grinding machine they were found to run out in the center. After the pin was hardened it was put on centers and trued up by an emery wheel.

After being trued up they were found to be soft on one side and hard on the other.

(The hard and soft sides were accounted for by the pin running out and the hardening only going in 1-32 of an inch.)

After an unsuccessful attempt to keep the pin straight during the hardening process, the process was finally abandoned. Another bad feature of the pins hardened in this way was the heating of the brasses.

I remember during this period of hardened pins I was roundhouse machinist at a point where the engines had these hard pins in their main wheels. When the babbitt would not stay in the brass we used leather or soap.

Our troubles ended when they pulled out these pins and put in steel ones not hardened. (These case-hardened ones were made of iron.) Now, Mr. McAttee's crankpin consists of an ordinary crankpin turned down a little, as shown by cut No. 1 on the sketch.

A case-hardened bushing, No. 2 on the sketch, and the usual washer (hardened), and nuts as before, as indicated by No. 3 and No. 4 on the sketch. Only the washer here has a dowel-pin in it.

No. 5 represents the pin complete. A few of the benefits of this proposed pin, as brought out by Mr. McAttee, are as follows:

The pins themselves all turned the same size; also all the bushings the same size (for a certain class of engines). Now, the benefit in this is that if anything happens to a bushing on the road, it can be slipped off and a substitute put on out of the engineer's box, and the train proceeds. Now, at the same time, the pin does not wear any, and is always standard.

These bushings can be had on stock in the storeroom or in roundhouses, and, as I said before, an extra one on the engine.

The dowel-pin fastened in the washer slips into its hole, which is one-half in the pin and one-half in the bushing.

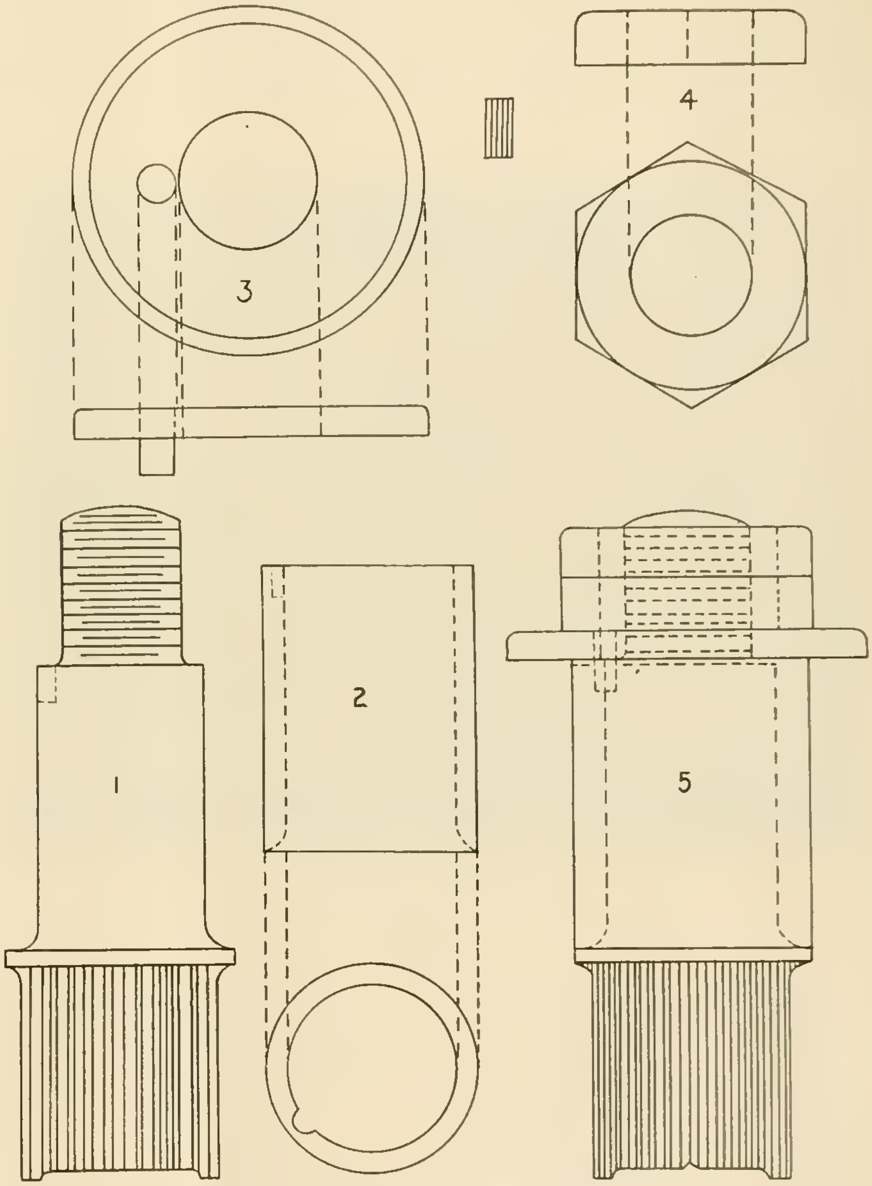
This construction of dowel is to help prevent the bushing from turning around on the pin.

The bushing is left 1-32 of an inch longer than the body of the pin, so the nuts force the washer to bind the bushing, so as not to allow the dowel to do all the holding.

The thickness of the bushing and the size of the dowel depends on the size of the rod brass.

Another advantage of this pin is that all the pin bushings being of a standard size, the rod brass bushings can be cast very near the size of the pin bushing, and then there only needs to be one cut taken out of the brass.

As heretofore, the bushings had to be cast small enough on the inside to accommodate small pins (pins that had worn small), and new ones as well. This saves a lot of brass.



McATTEE'S ADJUSTABLE CRANKPIN BUSHING

Another, and one of the most important points of this pin, is the fact of the brass having a bearing on part of the pin itself next to the wheel, and thus taking part of the strain off the bushing.

The fillet in the pin, both outside of the wheel as well as inside, retains the strength of same. JOHN W. PERCY.

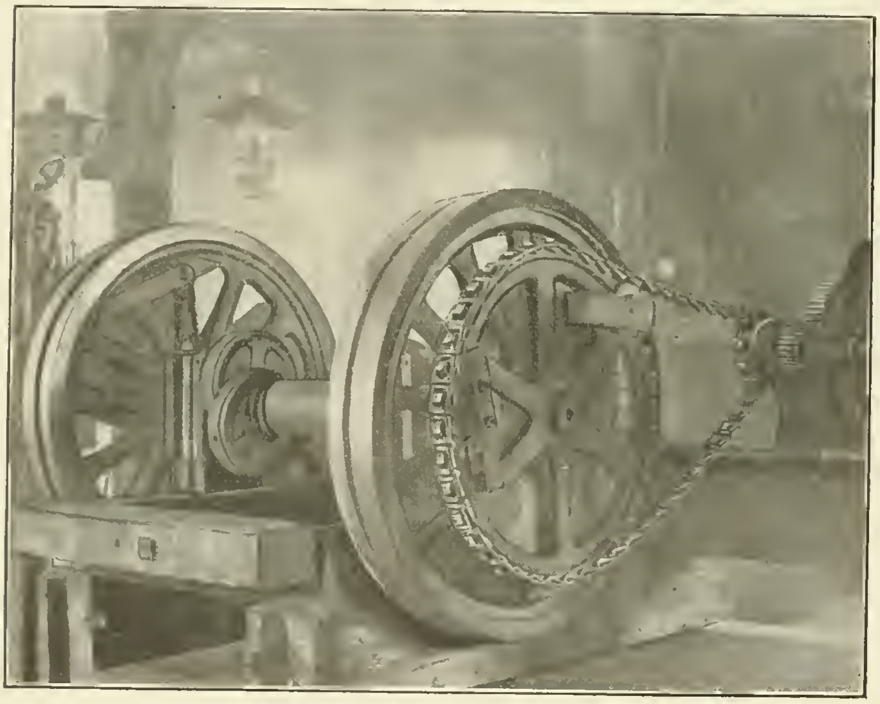
South Tacoma, Wash.

Improvised Wheel Lathe.

Editor:

In reading the description of new machinery and shop equipment each month, and their capacity for turning out work, it occurred to me that perhaps it would interest some of the readers that are located in well-equipped shops, with well-appointed toolrooms at their command, to learn how some of us less fortunate, who have light machinery, and little of it, and heavy work to do, have to scheme to get out the work with the tools that are at our command.

We had an engine in for general repairs that had driving tires 56 ins. in diameter which needed turning. The largest lathe in the shop had 28 ins swing. The enclosed photograph gives a view of the method adopted while the main pair of tires were being turned. It is not necessary to describe the operation further than to state that the driving boxes were turned upside down, and the axles rested in them, with a block of wood in place of the collar, with a cross strap bolted on to keep the wheels from rising up when a cut was being taken.



IMPROVISED WHEEL LATHE

While we were not able to turn out from four to six pairs in ten hours, as some modern tools are doing, they were turned out cheaper than the tires were from an engine that was in the shop previous to this one, that were shipped to an outside shop. W. J. Shreve,
Master Mechanic.
Minneapolis & Rainy River Ry. Co.,
Deer River, Minn.

Test the Gauges.

Editor:

In regard to the Birmingham Southern Railroad engines described by A. J. Monfee in your August issue, and his claim that one with 130 lbs. of steam was stronger than the engine with 145 lbs. pressure, everything else being alike, permit me to state that the engine with higher pressure might have been standing on a frog or guard rail binding or on a curve with poor adhesive advantages; or, supposing that the engine did not slip, it might have been on the dead center on one side just as the hard pull was at the limit. The driving brake might have been crowding against the wheels, which is a great drawback in starting heavy trains. Again, the higher pressure engine might have been forcing water into the valves and cylinders, which very greatly affects the tractive power. I would also suggest having the steam gauges of both engines tested.

Yours truly,
E. B. Thrall,
Plattsmouth, Neb.

Find Cause of Engine's Weakness.

Editor:

Owing to the interruption of long holidays, I have only now read your August number, and noted the case mentioned by A. J. Monfee, where an apparently weak engine hauled a train that an apparently more powerful engine failed to move. You invite discussion of this phenomenon. Well, my opinion is that the first move to find out the cause of the difference is the application to both engines of the steam engine indicator. When an engine of a given power fails to come near doing the work done by another of similar proportions something is seriously wrong and the steam engine indicator will greatly aid in locating the cause of inefficiency.

The steam engine indicator has been applied to many locomotives, but it has nearly always been done to show the fine cards that a highly efficient or pet engine would produce. That is a case of using a fine instrument for a wrong purpose. It ought to be used principally to find out why bad-working engines do not use the steam properly. If the steam reaches the pistons without obstruction, one engine of the same inches will do as much work as another of the same class. When decided difference exists the cause is almost certain to be in the steam passages. A displaced core that has left a restricted passage in the cylinder steam passage is a common cause of trouble; but there are others that the indicator will help to locate.

I once knew of a mysterious trouble with a new engine that failed to work satisfactorily and was laid up as a hopeless case. A bright machinist asked permission to go through the engine, and he found that a plate used to center the dry pipe had been left on, and all the openings for steam passage were two ⅝-in. holes. Mike Whalley.
Scranton, Pa.

Wearing of Cylinders.

Editor:

In reference to the question being discussed as to why the top part of a cylinder wears fastest, I have often thought that as piston and packing rings by their own weight would make a closer fit on all other parts of the cylinder than on the top, and as packing rings are sprung out of a true circle when they are put in, this would also tend to leave an opening at the top, and steam would blow through there, taking away lubrication at that point, thereby causing the most wear.

Cincinnati, O. T. Donovan.

Cleaning Injectors.

Editor:

It may not be new to you, but it may be new to many of your readers to know that there are other methods of cleaning injectors besides having them taken apart and scraped and ground by machinists with the result that the injector often works very badly after getting an overhauling. The water in this locality contains many impurities which in a short time affects the working of the injector, and the method of cleaning them adopted here lately consists in having the barrel and other parts of the injector placed in a bath of spirits of salts and then dropped in cold water and the parts become as clean as new. About 15 minutes is long enough in the bath which is lined with sheet lead and fitted with a cover to prevent the fumes of the spirits from escaping.

THOS. MOFFAT.

Montgomery, Ala.

Grinding a Throttle Valve.

Editor:

James Kennedy stated in your last number some things about the balanced throttle valve that should be taken with a grain of salt. He says that "Engineers are the only men who know how to close a throttle valve." He must be one himself. I venture to state that the average machinist will close the throttle valve with as good judgment as any man, and will not bang the seats out of shape, either. Mr. Kennedy has never ground many throttle valves, or he would know by experience that you must put your weight on the valve, or it would be a long job. I have ground in a good many throttles, and have seen many more ground. My chief trouble has been, if the throttle leaked, that the top disk of valve expanded more than the bottom one, simply because the upper part of valve had the most metal. The best method is to grind in your valve in the ordinary way, lifting your valve every three or four turns. After your seats are finished, wipe off the lower seat and oil it, put emery on your top seat and grind it till you can just feel it rock. Great care is necessary, as you may grind it too much. In coupling up see that valve is perfectly free, pins going in by hand. Take tissue paper and put four small strips under both seats, quartering them apart; then close throttle, and if it is a good job, you will find your strips of paper held firmly by the valve, and it will be tight.

Mr. Kennedy writes as if throttle failures were a common occurrence. In the shops that I have worked in it was a rare thing to have a leaky throttle after it had been ground.

WM. HAWLEY,
Chicago & Northwestern Ry. Co.

Superior, Neb.

Improved Piston Fastening Device.

Editor:

The enclosed is a view of an improved piston-rod fastener, doing away with the key and keyway.

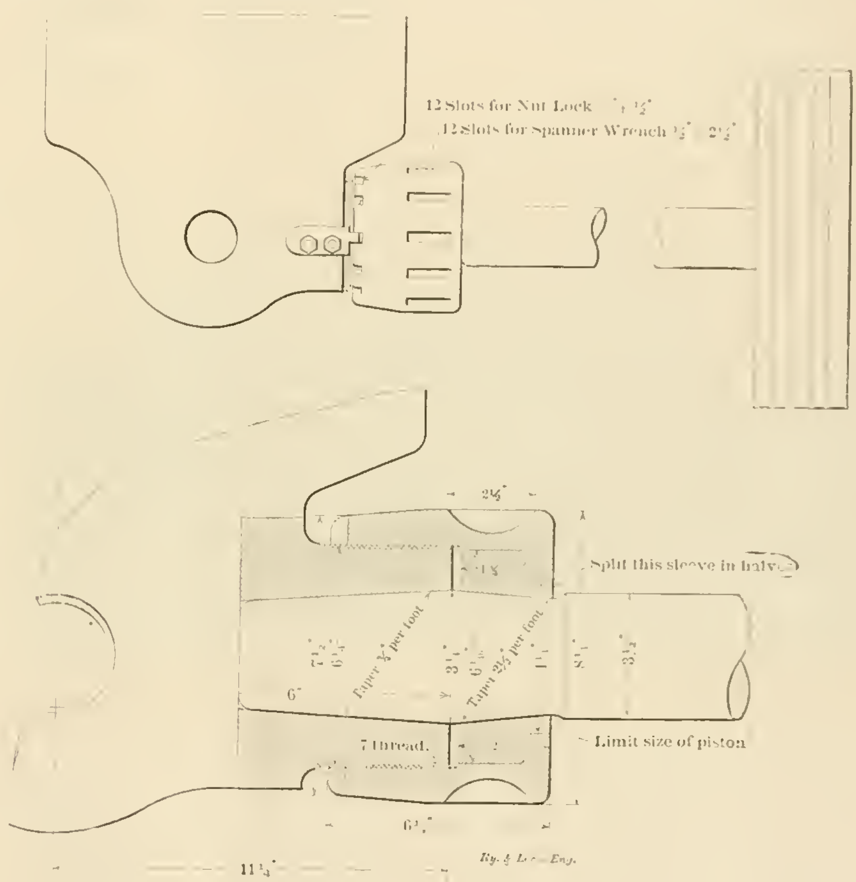
We have had considerable trouble with piston-rods breaking through the keyway, especially in passenger service. They invariably break in the keyway, and this fastening was designed to overcome this difficulty. It is applicable to any kind of crosshead having an extended boss.

You will notice in the drawings that the piston-rod is turned down to the limited size, making a double taper, and split sleeve is fitted to the front taper and just fills the cast-steel spanner nut screwing on the outside of the boss of the crosshead. After it has been screwed up as tight as possible it is locked with a keeper engaging in a slot milled out on the back end of same.

This device absolutely does away with pistons breaking in the keyway.

C. T. MCELVANEY,
Master Mechanic.

Missouri, Kansas & Texas Ry., Denison, Tex.



PISTON FASTENING DEVICE.

Old-Time Railroad Reminiscences.

BY S. J. KIDDER.

Editor:

The man who got into the air brake business in the early days of that most important adjunct to safety in train handling had many experiences, and of all kinds and character, that do not so frequently fall to the present participant in that line of work. In those old days air brakes on engines and cars were a novelty, consequently very imperfectly understood, and very few men were there who had even a fairly respectable smattering of the subject, though with the not unusual perversity of human nature, occasionally one was found who, after a season of handling the brake, became imbued with the belief that he knew it all. It is not the province of this article to reflect upon any one who has a good opinion of himself, for the writer believes every one should be proud of his capabilities and be permitted to modestly express them on proper occasion, but before doing so should be able to make good his assertions in a convincing and practical way.

As a matter of fact, it hardly appears quite the sensible thing for any man to assert that he knows all about any subject, for everyone's brain capacity has its limit and no one follows any profession a sufficient length of time to attain that degree of absorption, even were he permitted to follow Methuselah in point of years.

In the event of so asserting, however, others are only liable to question either his common sense or the quantity of gray matter deposited in his upper story, for the man whom Dame Nature has provided with a fairly moderate supply of that very desirable commodity realizes his own inability, as well as that of humanity in general, to ever attain perfection in anything.

The writer is led to this chain of reasoning from an experience which followed not long after he had made his advent into the air brake business, the incident occurring at the time when quick-action brakes were quite in their infancy. On one of the prominent railroads leading out from Chicago some trouble was being experienced with the brakes on a milk train, one car of which had a quick-action brake that frequently "dynamited" when making close stops at short platforms, and surmising that this was the result of the too liberal discharge of air through the three-way cock when attempting to make a service application, I started out on a tour of investigation. On the morning in question, in company with the division superintendent, I took a train, intent on going up the line until we found the train on which was the recalcitrant brake and which necessitated a change of cars several miles out to a branch road on which would be met the one we were looking for.

Arriving at the Junction, upon alighting, we crossed the platform, and as we did so the superintendent remarked that the engineer, Dan Bunting, of the train we were about to take was the oldest engineer in point of service on the road, and wouldn't I like to take a ride with him? To this I readily assented and a moment later we reached the side of his engine where we stood until the engineer had reached the last driving box, completing oiling round; then, as he stepped onto the platform, I was introduced as a Westinghouse air brake man, who was on the road for the purpose of imparting air brake information, the Super concluding by saying I would like to take a ride on the engine with him. After giving me a cordial greeting, Mr. Bunting sized me up in a quizzical sort of way, then remarked: "Well, Mr. K——, I am glad to know you and have you take a ride with me, but I want to tell you right here I ran the very first air brake engine that ever came out of Chicago and have been running one ever since, and I want to tell you right here you can't teach me anything about air brakes." Now, I wasn't particularly surprised at the first assertion, for I was cognizant of the fact that on nearly every road entering the western metropolis there was from two to a larger number of engineers who advanced the claim of being the original air brake man in that bailiwick, but Dan's latter assurances somewhat staggered me for a moment, and after recovering my equipoise, which had been disrupted by his vehement manner of assertion, I replied: "Mr. Bunting, I am pleased, indeed, that some good fortune led my footsteps in this direction this morning. Like yourself I began handling air brakes at a quite early date, so continuing for the dozen years or so immediately following, the entire period being put in on an air brake engine and during which time besides handling the apparatus I made such study of its construction and operation as I was able; then for three years I was road foreman of engines, which, among other duties, required my filling the position as best I could of an air brake instructor, and since entering the brake business have made it a special study, but with all my experience running on an air brake engine, as instructor to others and hard study with a view of familiarizing myself with the business, I realize there is yet very much of which I am still in ignorance, and I feel that during the short time I will be permitted to spend with you from the abundance of your superior air brake knowledge I will be able to learn what would otherwise have taken me years to obtain in the general course of gathering it." A self-satisfied smile overspread Mr. Bunting's countenance as I began talking, but which soon changed to a more thoughtful mood, and finally, as I finished, he wore a look of troubled perplexity.

Immediately following he looked at his watch, remarked it was about leaving time, and as he stepped through the gangway into the cab I followed, and shortly after was comfortably ensconced on the fireman's seat box. The train was of the regulation branch-run intermixture, composed of a 16x24 in. engine, baggage car, smoker and day coach, the former provided with a six-inch pump, small main reservoir and three-way cock, all of the brakes from pilot to rear hose being of the plain automatic variety. The conductor, a stocky individual, whose good nature was apparent, judging from both his pleasant face and manners, soon came up with running orders, exclaimed all right, go ahead, but with the admonition to wait until he got aboard, and as he mounted the smoker platform the fireman conveyed the signal, and we were off across the rolling prairie of Illinois. The time between stops was not fast, perhaps thirty-five miles per hour, and we leisurely loafed along and had covered perhaps a half dozen miles when a station loomed up in the distance.

Dan shut off, sounded the station whistle, let the train drift for a time, then, reaching for the three-way cock handle, gave it a full sweep, quickly emptying the train pipe. Immediately the brakes took hold with a firm grip, the train as suddenly responded to the violent retarding effort, and very quickly the brake valve handle was moved to release position. A second time the handle went to the "corner" in emergency position only to be followed by another release of the brakes. By this time the engine was passing the station and once more the three-way cock handle reached the end of its application traverse and as Dan saw that we were going by the platform he reversed, stopping at the proper place, but as the train came to a standstill the engine, whose driving wheels picked up and slipped shortly before stopping, caught the sand just as the stop was made, and gave a tremendous jolt against the baggage car and which was augmented by the several inches of link and pin slack behind the tender.

"There," said Dan turning to me, "you can see how they keep up the brakes on this dod blasted train." "Why," said I, "it was my impression that the car brakes were in fine condition to judge from the way they responded when you applied them." This apparent reflection on Dan's idea of good brakes nettled him not a little, and in a voice anything but modulated he exclaimed, "Perhaps you think you can handle these brakes better than I can?" "Well," said I, "while considerably out of practice and do not know the road, I can do a whole lot better than you did." Jumping from his seat box he reached across the cab, caught me by the shoulder, pulled me over to his side of the engine and shouted, "Try it," and as I mounted over the reverse lever quadrant he took my place on the opposite side. Looking back, the signal was given to go and we pulled out for the next stopping place, where I was to show Dan, if possible, some improvement over his method of making service stops.

In reply to my query he gave me the distance to the stopping point ahead, lay of the land, time, etc., and ended by saying we would round a long, easy, level curve in approaching the station, and that I could plainly see where I was going. We soon reached the whistling post where I shut off and whistled and, when at what appeared to me the proper point, a five-pound train line reduction was made, to which the brakes responded satisfactorily. Another reduction of a few pounds followed, the train drew up at the station platform, and, with a movement of the three-way cock handle to release just at the proper moment, a perfect stop was made. At this time I was congratulating myself on making a stop so much more perfect than I had anticipated, considering my lack of knowledge of the road and other things so essential to good braking, when I was startled from my reverie by Dan who, leaning well across the cab, and who had been intently watching the air gauge while the stop was being made, ejaculated: "Well, I will be eternally smashed! Will a little air stop a train like that?" And to which I replied, "You saw what it did do."

Dan had just began to make another exclamation when the conductor walked up to the gangway, discovered his regular engineer sitting on the fireman's box, threw up his hands, and, with a preliminary remark that would not look well in print, said with emphasis: "Dan, you can't fool me; I knew you never made that stop."

As the conductor turned about to walk away, Dan resumed the conversation by remarking: "Let's see you do that again."

"No," I replied, "I have filled my part of the contract; now let's see you experiment a little on my lines." I did not leave him for an hour or more later, and during that time his braking showed decided signs of improvement, but somehow he failed to grasp the proper method of releasing when coming to a stop to an extent that the conductor could not recognize when Dan was at the air brake helm. During that hour, too, I found there were a great many things about air brakes Dan did not know, but, be it said to his credit, he became an earnest pupil, and many a pleasant and profitable hour I spent with him in years after and up to his retirement from service on a comfortable pension from the railroad company he had faithfully served for a very long term of years.

Annual Report of the American Locomotive Company.

The fourth annual report of the American Locomotive Company, covering the period from July 1, 1904, to July 1, 1905, shows gross earnings amounting to $24,150,201, with expenses amounting to $19,796,533. During the year a permanent investment of $1,883,557 was made in the purchase of the locomotive works at Montreal. The usual 7 per cent. has been divided among the shareholders of the company's preferred stock, and after all deductions from net earnings a surplus remains of $607,924.

In the year ending there were other additions to the property amounting to $466,952 and betterments costing $131,251, all of which have been charged against the "extraordinary improvement and betterment fund" of $1,000,000 created June 30, 1904. The preferred stock of the company, and on which 7 per cent. is guaranteed, amounts to $25,000,000. The common stock amounts to the same sum. Ten separate locomotive works are now owned and controlled by the company. These embrace the works at Schenectady, N. Y., Dunkirk, N. Y., Allegheny, Pa., Richmond, Va., the Rogers works and Cooke works at Paterson, N. J., Providence, R. I., Scranton, Pa., Manchester, N. H., and Montreal, Canada.

The Helping Hand.

It is very gratifying to observe the monthly reports of the Employees' Relief Fund for the Pennsylvania Railroad lines east of Pittsburgh and Erie, and mark how well the method of mutual protection and benefit is carried into effect by the wise forethought of the workmen who, out of their necessities, save something for the dark days of adversity that come sooner or later to many.

From the last report, just published, it appears that the payments of benefits to the members and the families of deceased members amounted to over $117,000, of which $51,116 was on account of disablement by sickness and accident. The payments thus far amount to nearly $14,000,000, of which $5,669,187 was on account of death of members, and the balance on account of disablement.

The Time Record for Locomotive Building.

The fastest time in which a locomotive has been completed is eight days. The test was made at Baldwin's, at Philadelphia, some years ago, and a like test has not been made since. The Cornwall & Lebanon Railroad placed an order for a locomotive which it wanted for immediate service. The engine was made from plans especially prepared for it, and was in no way made up from stock parts. It was at work ten days after the order was delivered.

The *Times of India* is jubilant over the introduction of parlor and sleeping cars on the Great Indian Peninsula Railway, running between Bombay and Poona. The distance is 119 miles and the time occupied between the two terminals is 3 hours and 45 minutes.

The annual report of the Baltimore & Ohio Railroad Company has just been issued, showing gross receipts from July 1, 1904, to July 1, 1905, to be $67,500,000, an increase of 4 per cent. over the receipts for the previous twelvemonth. The expenses are nearly $45,000,000.

Three of the new roundhouses of the Erie Railroad are to be equipped by the B. F. Sturtevant Co., of Boston, with complete heating systems, particularly applied for thawing engines during winter. These include the roundhouses at Marion and Kent, in Ohio, and also at Hammond, Ind.

The C. W. Hunt Company have just issued a book of forty-eight pages, dealing with Manila rope and especially relating to its use for the transmission of power and hoisting. It should be in the hands of all who are interested in these subjects.

When a Man's Poor.

A man is poor when he has lost the confidence of friends, when people who are nearest to him do not believe him, when his character is honeycombed by deceit, punctured by dishonesty, says the *Centre Campion*. He is poor when he makes money at the expense of his character, when principle does not stand out clear, supreme in his ideas. When this is clouded he is in danger of the worst kind of poverty. To be in the poor-house is not necessarily to be poor. If your character stands four-square to the world, if you have never bent the knee of principle to avarice, you are not poor.

Vast improvements are in progress along the route of the Erie, including an important cut-off between Middletown and Port Jervis, a doubling of the track east of Jamestown, and a shortening of the track near Portage.

TEN-WHEELED LOCOMOTIVE USED OVER THE ST. GOTHARD R. R. OF SWITZERLAND FOR PASSENGER SERVICE.

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Busy Railroads.

The prosperity that has settled like a benediction on this broad land of ours speaks more eloquently perhaps through the reports of the railroad companies than through any other vehicle of industrial activity. The reports have all one glad story to tell. It is of extraordinary freight movement and passenger traffic, with the result of greatly increased earnings and higher dividends; in brief, an era of prosperity.

It is pleasant to realize that in this national song of joy there are no discordant notes. Under this serene canopy of peace and plenty there are no clouds to mar the prospect of the nation's well-being. There are no serious labor disturbances, no foreign intrigues or malice domestic to add notes of discord to the jubilant joy of labor well employed and well requited. There is nothing to disturb the national gladness in the enjoyment of the present or dim the rosy vision of the future.

The railways are the arteries of the nation. Like the pulse-beats of the nation's heart, they tell the true story of the nation's welfare, and when they are full and strong the nation is prosperous and the people contented.

A Locomotive Anniversary.

It was a happy thought on the part of the Baltimore & Ohio Railroad Company to mark the seventy-fifth anniversary of its early experiments in the first use of steam for the moving of passenger traffic in America. It was a momentous epoch in the world's history that witnessed the development of the steam engine into a vehicle of transportation, and while it must be admitted that George Stephenson had already done a great deal to introduce the use of the locomotive among the British people, it must also be admitted that Peter Cooper did much to bring its utility to the notice of the people of America. Neither of these eminent men and great public benefactors was an inventor in the sense of creating or developing a new world power. James Watt's marvelous engine was already perfected. But in the wide realm of adaptability, in the readiness to seize on what was already invented and prominently place the new uses to which it might be put before the slow-moving force of public opinion, both of these notable men, by the force of their individuality, achieved marked triumphs which it is proper to fittingly commemorate.

Without the use of the locomotive one can hardly imagine what America might be to-day. From its use the whole modern system of transportation has come. It has been the most potent factor in the stupendous revolution that has taken place in the world of commerce, and in all the relations of industrial life. It has opened up to civilization the trackless wildernesses of the West. Communities which under other conditions would have remained in comparative isolation are brought into constant and close relationship with each other; in brief, the locomotive has made possible the perfection of transportation methods and opened the way for the fuller development of human activities.

If we would appreciate fully the transformation that has been wrought, we might contrast the appearance of the one or two little locomotives built in America seventy-five years ago, weighing about four tons, and drawing a small carriage with a half-dozen passengers and a few parcels of merchandise over a few miles of road, with the 45,000 locomotives of to-day, traversing over 210,000 miles of railways, carrying 720,000,000 passengers annually, not to speak of the countless billions of tons of merchandise that are moved from State to State; and yet these figures convey but a dim impression of the social revolution that has been wrought, of the increase of comfort, the interchange of commodities, the general uplifting of humanity to a higher plane of life than could have been possible but for the inception and promulgation of the use of the modern locomotive.

A Conflict of Forces.

The opening years of the twentieth century see a commercial war of great magnitude being waged between the forces of steam, gas, electricity and oil for supremacy as a motive power, and the end of which no man knows. The merits of the reciprocating steam engine, the steam turbine, and the gas engine are being tested with varying results. Steam as a tractive force is being assailed by electricity, and now electricity is being assailed by gas and oil, which also direct their powers against steam. In spite of the great efforts made by these colossal forces to dethrone the steam engine, it need not be imagined that there is any probability that the steam engine will become a dead factor as a transportation force. Indeed, the potentialities of steam are not yet fully known. As far as the gas engine is concerned, it has been clearly demonstrated that the best work of the gas engine has been rivaled by that of the steam engine.

In regard to electricity, it already seems as if the drift of competent opinion is that it has seen its best days in the matter of lighting, and that its best work in the future will be in the rapidly expanding field of power distribution. Perhaps its most successful rival has been found in the recent remarkable development in the success of the petroleum-driven car, not only as a formidable rival to the electrically driven car, but as raising the question that if petroleum can propel a car at such a high speed on a common highway, how much better can it drive it on rails? The indications at present point to the fact that, while the cost of the rolling stock is increased by the use of oil as a motive power, the running cost per mile, as compared with electricity, has been greatly reduced. It is being further definitely established that, as far as capital outlay is concerned, electricity could not successfully compete with petroleum, and that, as already stated, the running expenses would be considerably less by the use of the latter. Other oils besides petroleum are being successfully used for car traction; and it is obvious that if the use of oil is eventually to supplant electricity, the greatest losers will be the municipalities and other corporations whose expensive electrical plants will be doomed to an early destruction.

The use of oil as fuel in steam locomotives has shown by recent experiments on the Santa Fe and Southern Pacific Railroad that the mechanism necessary to be attached to a coal-burning locomotive so that oil might be used as fuel involves a small outlay and that the results are of the most satisfactory kind; the continued success of the oil-burning locomotive depending, of course, on the supply of oil, which in Southern California and other parts of the Southwest is said to be illimitable. It is certainly an important double advantage which favors the continued use of the steam locomotive on railways when in the coal-producing regions means have been found to use the smallest kind of coal dust, hitherto considered entirely useless, while in those portions of our country remote from the coal fields petroleum is found in such quantities as render its use at a cost even less than that of the culm-burning locomotive.

The Growth of the Locomotive.

To a railroad observer, the modern locomotive presents a growth in the past few years over the older form that makes it of great interest when investigated from its several approaches. It is very easy for the layman even to notice this growth in the larger outlines of the machines of to-day, when compared with those smaller of early years, and here the comparisons would end for the layman; but to the railroad man, there appears many broad opportunities for comparison.

The huge "battleship" of to-day, with its cars of three-fold increased capacity and train of four-fold increase in length, tell a tale of enormous advantage from the traffic point of view; and it is perhaps the strongest comparison, as it appeals to the operative management and to the pocket-book of the stockholder.

The engineering department observes most forcibly the increase in the strength of bridges, the solidity of the rock-ballasted road bed, and the greater weight of rails. The locomotive engineer finds the handling of the heavy modern trains a much more delicate problem than he did a shorter train of a few years ago. The fireman, instead of feeding a single shovel of coal at a firing, as was his custom with the smaller fire box, finds a much heavier task of keeping the grates of a larger fire box supplied with coal. Indeed, so great has the task become, that only a man of exceedingly robust and rugged physique can stand the severe manual strain, and the general introduction of the automatic stoker seems to be only a short way off. Already experimental mechanism is now in trial service and promises to reach a degree of perfection to permit of an early installment of mechanical firing.

It has been a matter of history that American railroads have not reached their final location until after one or more rebuildings and relocations. Grades have been reduced, curves eliminated, until, as a railroad man recently termed it, "The roundhouse is made to pull the contents of a railroad yard and the engineman requires a telescope to see the caboose."

Sentiment That Promotes Efficiency.

"We must get the maximum possible hauling capacity out of each pound of locomotive and each pound of fuel," declared a president of the American Railway Master Mechanics' Association in his inaugural address, and it was expressing in succinct form the sentiments constantly finding expression in that association since it was formed thirty-nine years ago. We know of no organization that has labored so zealously and persistently for the high ideals of its origin than the Master Mechanics' Association, and its example has stimulated others to labor in season and out of season to make every dollar spent by railroad companies bring back profitable returns. The prevailing sentiment in favor of high efficiency has been of great benefit to railroad companies and the association that has done so much to nourish and cultivate the sentiment has often received scant justice from its beneficiaries.

People who are constantly agitating for the introduction of the metric system to promote uniformity in weights and measures might profitably devote their energies to reforming some of the glaring inconsistencies to be found in different States. In Pennsylvania, for instance, a bushel of coal weighs 76 pounds, while in Indiana it is 70 pounds. In several States the bushel of coal weighs 80 pounds and there is not uniformity even with that. A bushel of coke varies in the different States from 33 to 50 pounds.

Revival of Compound Sentiment in Great Britain.

When compound locomotives first became fashionable in France and other continental countries, some of the British railway companies adopted that type of engine to some extent, the London & North Western being an exception by building little else for several years. Very little experience with compounds was enough for most of the companies, and in 1904 not a single compound was built for any railway company except the London & North Western. Now there seems to be a revival of the sentiment in favor of compounds. We understand that five or six of the larger railways are having compounds built at the present time.

Three-cylinder compounds are being built by the Midland Company at Derby, the intention being to use them for hauling the Scottish expresses between St. Pancras and Carlisle, and the Great Central are constructing an immense three-cylinder "Atlantic" compound.

A four-cylinder compound has been completed by the Great Northern Railway, and another has been delivered to them by the Vulcan Foundry, Lancashire.

The North-Eastern Company, who already possess the heaviest and most powerful engines in operation on British lines, are having two four-cylinder compounds built, which will be the heaviest ever run over British rails.

French makers have supplied the Great Western with the two compounds which they are about to try on their system. They are of the De Glehn type not unlike that imported by the Pennsylvania Railroad Company last year.

A good thing about most of the British railway companies is that they do not follow a new departure in motive power design blindly and keep shouting in its favor because it is different from old forms. The record of fuel used is kept so accurately that the exact merits of every class of engine is soon known. We believe that the reports on the performance of their compound locomotives which will be made public by British railway men a year hence will be worth reading.

Safety Appliances on Cars.

Considerable interest is being shown in the additional car orders to be placed by the various railroads late in the season. While the principal reason for this is the greater demand for cars, it is also said that the railroads are anxious to be able to make a good report to the Interstate Commerce Commission regarding the number of cars equipped with air brakes and other modern safety appliances. The commission has asked that each road shall report the number of cars equipped with air brakes during the past six months, and on October 1 will demand that 60 per cent. of the cars of each train shall have the air brakes connected. Another object of the railway companies is to do away with the light-weight cars and establish in their stead the more up-to-date steel car equipment. It is understood that the Pennsylvania system, which probably operates more cars equipped with air brakes than any other road, will insist that the cars of foreign roads delivered to them for transport shall have the air brakes and other safety appliances. Within the past few years the work of equipping freight cars with the different devices has progressed wonderfully, and it is estimated that in a comparatively short time all the freight equipment of the country will have these devices.

The Unsatisfactory Big Locomotive.

There is no sign that the building of huge locomotives is on the wane, but it is a little difficult to understand what influences urge into use so many engines that are nearly as large as can be used, for in railroad circles one seldom hears a word said in favor of the mammoth engines, and many people are ready to speak plainly against them The recurring criticism is that the engines fall far short in efficiency of the smaller engines that have preceded them. In this connection the designers and builders frequently come in for uncomplimentary comment, the question constantly being repeated, why are the heavy engines not made as good for their inches as the small engines were? The large engine ought to use steam more economically than a small one in proportion to its size, but the conditions of train service and car hauling often prevent its merits from being displayed to the best advantage.

Let us compare a common locomotive of thirty years ago with one of the modern powerful types. In the early seventies a common and favorite form of locomotive had cylinders 16x24 inches, driving wheels 60 inches diameter and a boiler providing 1,000 square feet of heating surface, 15 square feet of grate area, the steam pressure being 130 pounds gauge pressure. The tractive power, which is the essential consideration since it hauls the trains, would be about 8,000 pounds. Total weight about 60,000 pounds, 28,000 pounds being on the drivers.

Among the powerful locomotives built during the last few years, it is easy to find one with four time the tractive power of ancient engines just described. An engine of this capacity will have cylinders 22x28 inches, driving wheels 66 inches diameter, a boiler 70 inches diameter, carrying steam at 220 pounds guage pressure; heating surface about 4,000 square feet and other dimensions suitable for the great power developed.

To make a fair comparison of the large engine with the small one, we must find out how the expenses of the large engine compares with the expenses of four small ones required to haul the load hauled by the huge engine. Apart from the extra expense of wages for handling the four small engines, it will be found that the single powerful unit uses considerably less coal and a smaller quantity of lubricants. The difference in wages is the most important saving in the employment of heavy motive power, but the reduction in other expenses is important enough to promote sentiment among officials in favor of large locomotives.

We believe, however, that the movement in favor of very powerful locomotives has led to the purchase of engines far too heavy for the ordinary run of work, and that the cost of train operating is largely enhanced through underloading of the motive power. All over the country we see ten-wheel and mogul engines, some weighing over sixty tons, hauling trains no heavier than engine and tender. It is all right to provide a fair margin of power, but an engine pulling a train one-tenth its capacity, is an expensive absurdity. Double heading of locomotives is not a good practice, but it is better to put two engines on a train occasionally than keep in service a stock of huge machines that are generally worked far below their capacity.

In many cases railroad companies have followed the fashion of ordering heavy locomotives without giving proper consideration to the traffic conditions under which the engines will be operated. Unless an engine is loaded near its full power, it will be worked at a loss, for its extra weight over a smaller one is wasteful dead weight. If the engines are loaded with trains that are too long for the passing tracks, delay and annoyance will ensue. The large engine is also expensive to keep idle in side tracks and in front of delayed trains, for they burn much more fuel when standing idle than small ones do. That is a source of loss that has given the large engine a bad name on many divisions. If a railroad company does not have the facilities for giving a full load to heavy locomotives and of keeping them moving with few siding delays, they are better to content themselves with engines that can be fully loaded and kept moving.

Profit from By-Products.

A few years ago an investigation was made of the profits made by gas companies that supplied a great American city with lighting gas, and it was discovered that the by-products of the coal that was used for conversion into gas more than paid the whole expenses of the company. It is to be presumed that all other gas companies use up the by-products of the coal in the same profitable manner.

The advantage accruing to the community from the saving of what used to be worthless material is one of the triumphs achieved by the science of chemistry. Coal tar, one of the by-products of gas-making, used to be considered a worthless liquid, difficult to be got rid of. Now the elements that composed that malodorous stuff are separated and converted into very valuable articles of utility and luxury. The first derivatives from the distillation of coal are coal gas, gas liquor, coal tar and coke. From the gas liquor are derived ammonia and sulphate, chloride and carbonate of ammonia. The coal tar is split up into oils lighter than water or crude naphtha, oils heavier than water, such as creosote and pitch.

From the coal tar comes an endless variety of combinations. The greatest industry based upon their use is the manufacture of dyes, there being over 600 different coal tar colors in use. Most of the beautiful new colors used in the arts are derived from coal tar, and some of them are so expensive that only very rich people can buy them. Many medicinal preparations come from the same source, while pitch for paving purposes is one of the commonest products.

Book Notice.

Practical Perspective. By Frank Richards. Publishers, the Derry-Collard Co., New York. 60 pages. 12mo. Price, 50 cents.

This excellent little work presents in compact form the principles of isometric projection, and will be of much value to mechanics generally. It is a well known fact that many skilled mechanics are utterly unable to sketch anything in perspective. Yet it is of great value to the mechanic. Working drawings are in many instances not effectively descriptive to the ordinary artisan. This is particularly true in regard to machinery, where in many instances more than two views are necessary for a comprehensive vision of the object. Mr. Richards not only explains the principles of isometric perspective, but by the use of isometric sketching paper nearly all difficulty disappears, and a sketch can be made in very short order without the use of anything but a pencil. An ingenious sectioning of the paper provides the lines necessary for any angle of view, and correct drawings can easily be made without tools. The able little work ought to find its way into popular favor.

The Pennsylvania Railroad Company, in compliance with the regulations of the Interstate Commerce Commission, will handle no more freight cars for the New York, New Haven & Hartford unless equipped with air brakes and other safety appliances. The Pennsylvania has also issued an order in regard to the placing of a baggage car next to the locomotive as a means of protection to the cars carrying passengers. This rule will apply whether the car is needed or not.

The Texas & Pacific are building two monster locomotives at their shops at Marshall, Texas, to be used for the fast passenger trains—the Cannon Ball. The new engines will be of the Atlantic type with seven-feet driving wheels.

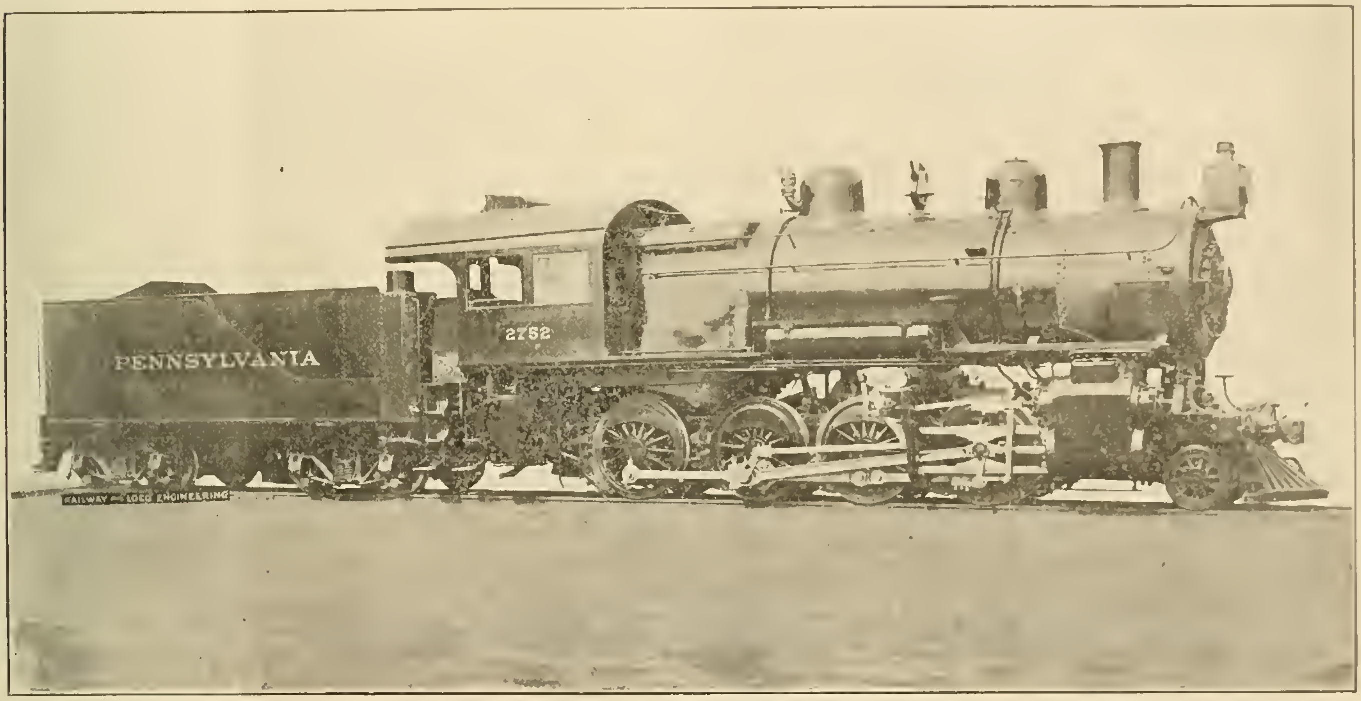
Powerful Consolidation Locomotive for the Pennsylvania Railroad Co.

The Pennsylvania Railroad Company has added extensively to the number of freight engines employed on its road during the year, and by the courtesy of Mr. Theo. N. Ely, chief of motive power, we are enabled to reproduce an illustration of the most recent addition to the locomotive force of the company. A large number of the 2-8-0 consolidated type have just been placed in service, and the reports of their work are of the most gratifying kind. The enormous tractive power of these engines admirably fits them for the heavy service which the bulk of the company's lines entail. The steaming quality of these engines is of the very best, owing, doubtless, to the vast amount of heating surface which is a marked feature of their boiler construction.

This type of engine is now extensively used in America, and it is generally considered as having now been developed into something approaching a final stage in respect of its dimensions. The four pair of driving wheels have a diameter of 56 ins., with axle journals measuring 9 ins. by 13 ins., the length of the driving wheel base being 16 ft. 3 ins., the total wheel base of engine, including the front truck, is 24 ft. 9 ins., and including tender trucks, the wheel base amounts to 58 ft. 1½ ins. The engine truck wheels have a diameter of 30 ins., with axle journals 5½ ins. by 10 ins. The cylinders are 22 ins. by 28 ins., with a spread of 88 ins. The valves are of the piston kind, 12 ins. in diameter, with steam ports 2 ins. wide; the travel of the valve being 6 ins. with a lap of ⅞ in.

The type of boiler is of the Belpaire wide fire-box variety, and is of very large proportions. It carries a working pressure of 205 lbs. per square inch. The smallest diameter of the boiler is 69½ ins. There are 373 flues, having an outside diameter of 2 ins. by 13 ft. 8½ ins. in length. The fire-box measures 66 ins. by 107 ins. The total heating surface of the boiler is 2,842 sq. ft. and the grate area 50 sq. ft.

The diameter of the wheels under the tender is 36 ins., with axle journals measuring 5½ ins. by 10 ins., the weight of the tender loaded amounts to 143,000 lbs. The tractive power of the engine is estimated at 39,688 lbs., with maximum pressure equal to ⅘ of boiler pressure. The equipment includes Westinghouse American locomotive brakes on all coupled wheels, as well as on those of the tender. As will be seen in the illustration, the valve gearing is of the Walschaert type.



PENNSYLVANIA'S CLASS H. 6 B.

New Railroad Appliances.

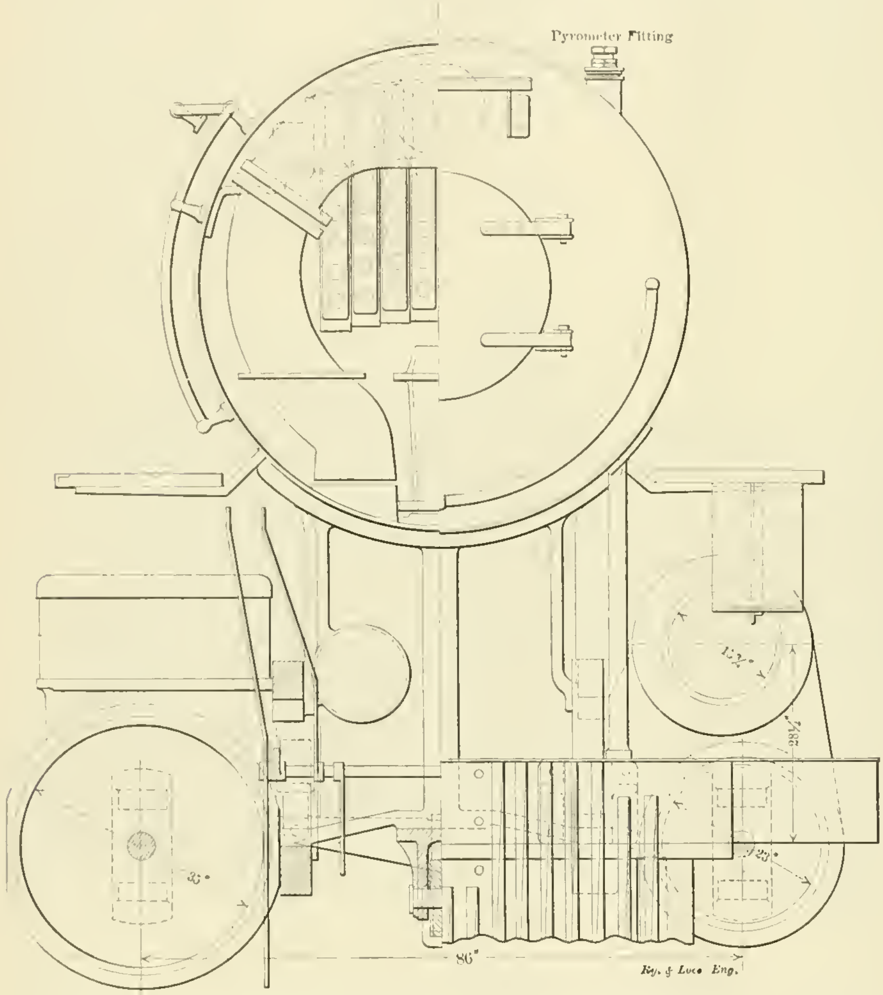
The desire for improvements in railway appliances has reached the New York, New Haven & Hartford Railroad Company. A new car window has been adopted whereby the passengers may easily raise the window to any desired height. It works as readily as a window shade and is a much needed improvement. The small bundle racks over the seats in passenger cars have also been abolished; the modern car contains a rack that extends the entire length of the car. Another novelty concerns the raising and holding in place the temporary platforms, that, when the outside doors of the car vestibules are closed, cover the steps. In the new car the brakeman presses a lever and a spring lifts the platform and keeps it out of the passenger's way.

Your Watch a Compass.

Every watch is a compass. If you point the hour-hand to the sun, the south is exactly half-way between the hour and the figure XII on the dial. Suppose, for instance, it is 4 o'clock. Point the hand indicating IV to the sun, and II on the watch is exactly south. If it is 8 o'clock, point the hand indicating to the sun, and the figure X on the dial is due south. No man need get lost if he carries a watch and can see the sun.

New Signal System on the Erie.

The Erie Railroad has arranged for the immediate expenditure of $225,000 for the installation of one of the most modern and efficient railway signals that has yet been put on the market. It is known as the Hall electric semaphore normal clear system and is operated by stationary storage batteries. The line between Bergen, N. J., and Middletown, a distance of 68 miles, is to be equipped at once. For the first 32 miles the signals will be put two-thirds of a mile apart; for the rest of the distance about one and one-third miles apart. It will require five power plants for charging the batteries, which will be located at Rutherford Junction, Ridgewood Junction, Suffern, Oxford and Middletown. The line to be protected has two and four tracks at different places and is the most congested part of the Erie system. Hitherto a manual block, which is a tower with signals operated by a towerman, has been used as a block protection, but it has been deemed best to install an automatic system for further protection and to accelerate the movement of trains. The new system will be extended over the entire line in the future.



FRONT END OF ERIE PASSENGER, SHOWING COLE SUPERHEATER AND DIFFERENT TYPES OF MAIN VALVES USED.

Testing Locomotives.

The Delaware and Hudson Railroad Company is now testing the speed and pulling capacity of all its locomotives with the aid of its improved dynometer car. While the capacity of locomotives has heretofore been determined by theoretical measurements, the dynometer will ascertain the same thing in a practical way, giving results by which the capacity of a locomotive will be closely gauged. Every locomotive on the Pennsylvania division of the Delaware and Hudson Company will be tested.

Educational Work.

The railroad branch of the Y. M. C. A. at Topeka, Kansas, opened the educational classes for the winter with an address by Governor Hoch on "The value of an Education." An excellent schedule is outlined for the coming year. Lectures by practical railroad men will form a leading feature. Among the instructors in the various classes are several of the railroad foremen. There are sixteen classes in all, being an increase of four over that of last year.

On the List.

On one of the old turnpikes yet remaining in the South, says *Harper's Weekly*, a big touring car had twice rushed through the gate without paying toll. The third time they made the attempt the tollman shut his gate and brought them to a stand. With indignation the half dozen occupants of the car declared they were entitled to a free ride.

"Look at your own board," said the spokesman; "it says, 'Every carriage, cart or wagon drawn by one beast, 2 cents; every additional beast, 2 cents.' We're not drawn by any beast at all."

"No, but here's where yew come in, suh," replied the tollman, pointing to another clause, as follows: "Every half-dozen hogs, 4 cents." "And three times four is twelve," he added.

The twelve cents was paid.

For a long time the engineering scientist kept aloof from gas engines of all kinds, regarding them contemptuously as expensive toys, with no prospect of future usefulness. It was the same kind of attitude that earlier scientists held toward the steam engine and towards nearly every other machine and apparatus that under the hands of practical inventors have become useful helps to mankind. We notice now that the scientists are beginning to pet and patronize the gas engine, particularly the kind used for automobiles. We are anxiously awaiting the appearance of the automobile whose engine is built according to the ideas of the pure scientist.

The great philosopher Socrates, one of the pioneer learned men, acquired information mainly through the practice of asking questions. When he felt that some one knew more about any subject than he did, he proceeded to possess himself of the other man's knowledge by asking questions. Some modern people are so afraid of displaying ignorance that they are ashamed to ask questions. People of that kind pass through life woefully ignorant and are never much use among the forces that keep the world moving.

Serpollet, the well-known automobile designer, is said to be working on a motor capable of maintaining a steady speed of 125 miles an hour. We wonder where a public highway can be found where such a rocket can be shot with safety.

The Boston & Maine Railroad Company has been experimenting with peat as fuel, and the result is said to be very satisfactory. The peat has great heating power, is free from smoke, and can be purchased for less than coal.

Mahogany has one great advantage over almost any other timber. Dry rot hardly ever attacks it. The finest mahogany comes from Cuba, the largest from Central America.

One of the most disheartening of all things is to be associated in an undertaking with a person whose promise is not to be depended upon.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. All letters intended for Our Correspondence School ought to be addressed to Department E.

Railway and Locomotive Engineering Educational Course.

BY ANGUS SINCLAIR.

When we began on the publication of these lessons it was done through an urgent demand for answers to the code of questions prepared for the examination of train men belonging to the Vanderbilt system of railroads. That course is now finished and we consider it wise to keep up this educational feature of RAILWAY AND LOCOMOTIVE ENGINEERING. Many railroad companies now have a code of questions of their own for the examination of their employees. We believed that it would be of benefit to our readers to answer the questions used by the leading railroad companies and we procured a collection of the pamphlets for the purpose, but on examination we found they differ so little from the answers that we have published, that we determined to arrange a new set of questions and answers which will for months constitute the leading feature of RAILWAY AND LOCOMOTIVE ENGINEERING Correspondence School.

Any of our readers belonging to other railroads where questions are used that do not appear in the Vanderbilt code, can have them answered in our Question and Answer Department if they will send them in. In this connection we will again assure our correspondents that their names will not be revealed or anything said by which their identity may be found out.

When considering what kind of instruction we should give in the new course, the writer reflected that thousands of our readers must be striving to follow a course of self-education similar to what he had acquired by many a weary hour of unaided labor over facts and problems hard to understand. He found that a serious waste of mental grade climbing was done through ignorance of easy paths that might have been followed in the search after knowledge. He found by experience and by searching that the books treating on Natural Philosophy contained the most valuable kind of information underlying the problems of railroad mechanics, and were easily applied when necessity arose. He, therefore, resolved to publish those elementary portions of Natural Philosophy which will serve as a foundation for what some of our readers may consider the real practical parts.

To some who have acquired intimate knowledge of Natural Philosophy, the preliminary questions may appear too elementary, but we presume to be dealing mostly with people who need elementary instruction. These questions and answers I intend calling

THE AMBITIOUS MAN'S CATECHISM.

1. What is matter?

A.—Everything that occupies space; solids, liquids and gases; otherwise earth, water and air are classed as matter.

2. Describe the leading properties of a solid?

A.—A substance that adheres strongly enough to oppose decided resistance to fracture, impression or penetration by other bodies.

3. What are the leading properties of a liquid?

A.—The coherence of the particles are so slight that they can move about with little resistance and are easily permeated by more rigid substances.

4. What are the leading features of aeriform or gaseous matter?

A.—It exists in such an attenuated condition that the particles repel each other, tending to separate and spread out indefinitely as in the case of unconfined steam.

5. What is a body?

A.—It is a unit of matter either solid, liquid or gaseous.

6. Do solid, liquid and aeriform bodies always remain in the same condition?

A.—No. All substances change under the forces of heat and cold. Heat will convert the most refractory solid into a gas, and cold and pressure will solidify the lightest gas.

7. What is a fluid?

A.—Liquids and gases are classed as fluids.

8. What are the essential properties of bodies?

A.—Impenetrability, Extension, Figure, Divisibility, Inertia, Porosity, Indestructibility, Compressibility, Expansibility, Mobility, Gravitation, Cohesion, Adhesion, Hardness, Tenacity, Elasticity, Brittleness, Malleability and Durability.

9. Define impenetrability.

A.—That property which bodies have of occupying a certain space, so that where one body is another cannot be without displacing the first one.

10. What is extension?

A.—The property of occupying a certain space—length, breadth and depth, which are called the dimensions of extension.

11. What is meant by figure?

A.—The shape taken by any body.

12. Define divisibility?

A.—The susceptibility of matter for dividing into minute parts. This peculiarity is most noticeable in the vast particles of coloring that proceeds from a grain of the substance and in the immense range of perfumes and odors.

13. What are the properties of inertia?

A.—Inertia is the tendency of a body to remain at rest or in uniform motion unless interfered with by outside forces. Inertia keeps the train at rest until the engine starts it, then the same tendency keeps it moving after steam is shut off, and it is brought to rest by the outside forces of friction, otherwise it would go on forever. The friction may come from brakes, the track, the atmosphere and from a variety of other sources.

14. What is meant by the term porosity?

A.—Owing to the atomic arrangement of the particles of bodies there are small channels or interstices between the more solid parts which are called pores. All substances are porous, but in metals and some rocks the pores are so minute that they can be detected only by the most powerful microscopes.

15. What is that property of matter known as indestructibility?

A.—It is the peculiarity which makes all bodies incapable of being destroyed. Wood or coal may be burned, water may be evaporated and sugar may be melted, but no atom of their elements has been destroyed. They merely assume new forms.

16. What is the compressibility of matter?

A.—The property possessed by all matter of being squeezed into smaller size. It is the closing up of the pores in solid bodies and the pushing of the particles into closer contact in gases. The working of an air pump illustrates how easily air is compressed. The forcing of bolts into close fitting holes illustrates the compression of metals. Cold compresses nearly all substances.

17. What is the expansibility of matter?

A.—In a general way it may be regarded as the reverse of compressibility.

18. What is the meaning of the term mobility?

A.—It is the property which renders the shape of a body capable of being readily changed. Water, for instance, is highly mobile because it can be easily moved about in its bed or vessel, although it is practically incompressible, much more so than steel.

19. What is gravitation?

A. It is a force or tendency in every body to attract other bodies to itself. The attraction of the earth is the best example of gravitation, but all other bodies possess the same attribute in proportion to their mass.

Questions Answered

NUMBER OF LOCOMOTIVES IN SWEDEN.

(92) L. L. M., East Grand Forks, Minn., writes:

How many locomotives are there in Sweden? A.—There are about 1,500 locomotives in Sweden, of which 700 are in the government service.

RUNNING LOCOMOTIVE BOTH WAYS.

(93) W. D. C., Allegheny, Pa., writes:

Would it be as safe to run a 4-4-0 engine backwards as fast as forwards, the tires being all good? A.—The eight-wheel American type locomotive can be run just as safely backwards as forwards. The element of flexibility is equally as efficient in the tank truck as in the engine truck.

DISHING OF DRIVING WHEELS.

(94) C. G. P., Chicago, Ill., writes:

Why is a driving wheel on a locomotive dished from outside to inside? A.—There are several causes which make this preferable. It affords greater space for flanges of driving boxes and wedges, and allows the frames to be set wider apart than if the wheels were dished outwardly. It also allows the center of crank pin to approach nearer the body of the wheel. It may be added that dishing adds to the resiliency of wheels.

HEAT CAPACITY OF METALS.

(95) L. B., Davenport, Ia., writes:

We have silver teaspoons that my wife turns out when we have company, and I noticed that the silver spoons get much hotter in the tea than the common plated articles. I have experimented with the spoons in water of different temperatures and find that the silver is always hotter than the other metal. What is the cause? A.—The difference lies in what is known as the heat capacity of the different metals. The amount of heat needed to raise the temperature varies greatly in different substances. Brass, from which common spoons are made, has almost double the capacity for heat that silver has, and will take in about twice the amount to raise it to a given temperature.

CUTTING SPEED FOR METALS.

(96) F. P., Springfield, Mass., writes:

What are the highest speeds in lathe and drill press work in cutting steel, wrought iron and brass? A.—The extreme degree of speed in cutting mild steel in a lathe is 100 ft. per minute, the estimate being from 20 ft. to 100 ft. according to the hardness of the metal and the quality of the tool. Iron, per minute, 120 ft., and brass, per minute, 200 ft. The rates of speed for drill press work are, in revolutions per minute, as follows:

Diam. of drill.	Steel.	Iron.	Brass.
1/8 in.	912	1,064	1,824
1/2 in.	228	266	456
1 in.	114	133	228
2 in.	57	67	114

DISTANCE TRAIN SHOULD STOP IN—DIFFICULTY OF DETERMINING.

(97) P. S., Laredo, Tex., writes:

A train running at the rate of 30 miles per hour is reduced in speed to 16 miles per hour, by making a full service application of the brakes. Brakes are released, and train line pressure run up to about 80 lbs. At that instant a switch is discovered thrown wrong, and an emergency application is made. How far would this train travel before it could be brought to rest, brakes in fair condition and working on engine and entire train. Train consists of engine and five cars? Would also like to know how many seconds it takes for brakes to be applied after a full service application has been made, and you release and at the same instant you find it necessary to make the emergency application. A.—As we have replied before to such questions, it is exceedingly difficult to attempt an intelligent answer to such a question at long range, not knowing the exact data regarding the braking power on the cars, condition of brake on engine, tender and cars, grade of track and condition of rail. The best we can do would be to refer you to tests which have been made, and in which the brakes on the cars are in perfect condition. We would refer you to the five car train brake tests held on the N., C. & St. L. R. R., in 1904, and as described in the Air Brake Association Proceedings of that year, also in Blackall's Catechism. The time required between a release and possible overcharge of the train pipe and a subsequent application, is variable and dependent upon the length of train and the excess pressure sent from the main reservoir to the train pipe. In an emergency application this latter item would not amount to so much, as would the time elapsing between the release of brakes and the subsequent application, the same being the time given to partly recharge the auxiliary reservoir.

AUTOMATIC OIL CUP—RATE OF FEED.

(98) J. A. J., Corbin, Ky., writes:

With the No. 1 Westinghouse Automatic Air Cylinder Lubricator, how many drops per hour is proper for lubricating the average of air pump air cylinders? A.—This, of course, varies with the number of cars in the train, the condition of the air pump, the number of leaks in the train pipe, etc. In some cases a cupful of oil has run an ordinary freight train engine two round trips, lubricating the cylinder and keeping it in excellent condition. This, of course, will vary with conditions.

EMERGENCY APPLICATION — PERCENTAGE OF TRAIN PIPE AIR GOING TO BRAKE CYLINDER.

(99) E. A. B., Brunswick, Ga., writes:

There is a question I would like to have you answer. When we use the emergency with the quick-action triples, we get both auxiliary reservoir and train pipe pressures in the brake cylinders, which equalizes at about 60 lbs. Now, what per cent. of each pressure do we get in the brake cylinder? A.—About 22 lbs. of train pipe pressure goes to the brake cylinder, and the remainder comes from the auxiliary reservoir. The 22 lbs. is gauge pressure, and is really about 36 lbs. absolute pressure, as the vacuum in the cylinder has to be filled before the gauge begins to register.

SLACK ADJUSTER—RUNNING AND STANDING TRAVEL.

(100) B. R. M., Ludlow, Ky., writes:

We have some cars that have the American Automatic Slack Adjuster on them. We find the cylinder is drilled to give 8 in. travel, but we find on measuring the piston travel that it is only 6½ in. Why does not the adjuster regulate the travel at 8 in.; what its cylinder is drilled for? A.—While the slack adjuster connection in the brake cylinder is drilled to apparently give 8 in. piston travel, still the adjustment is made by the slack adjuster when the car is running and all the lost motion in the journals, trucks, etc., is jolted together, making those parts more compact than when standing still, thus taking up the slack closer than could be done if the car was standing still and the lost motion in the parts were not jolted together. The difference in the running and standing travel represents the amount of slack motion in the running gear parts, the tightening of parts during brake application, etc. Therefore, you may expect to find an inch or two difference between running and standing travel.

BRAKE APPLICATION WITH LIGHT REDUCTION ON REAR CARS

(101) J. B. O'D., Freeland, Pa., writes:

In studying your Question and Answer Department I see a question I do not understand. If you have 100 cars cut in with Westinghouse Air Brake.

and engineer makes a 10 lb. reduction, how many pounds pressure will he get in the brake cylinder on the last car; he has 3,000 ft. of brake pipe? A.—A 10 lb. reduction would hardly get the pistons past the leakage grooves on the rear cars, as the brake pipe reduction in such a long train would necessarily be so gradual at each triple valve, that only the head brakes would be sufficiently influenced so they would respond to the reduction. Possibly the ten or fifteen rear brakes would not get set, especially if they were not in prime working condition.

HIGH SPEED BRAKE—TEN POUNDS' REDUCTION.

(102) R. L. B., Providence, R. I., writes:

We have just gone into high speed brakes, and I find when I set my brakes exactly as I used to, the brakes catch up and hold tighter and better than with the 70 lb. brake. Air brake men say that 10 lbs. reduction from 110 lbs. brake line will give same braking power as 10 lbs. reduced from the 70 lbs. train line. I find this is not so. Why is it? A.—10 lbs. reduced from a 110 lbs. brake line will give the same pressure in the brake cylinders as 10 lbs. reduced from a 70 lbs. brake line. You will find this true if you watch it closely. It must be remembered that 10 lbs. from a 110 lbs. train line will escape at the brake valve much quicker than a 10 lbs. reduction from a 70 lbs. pressure. You have probably misjudged your time of reduction, and actually more pressure has been discharged at the brake valve than the amount you believe. Look a little closer at this and write again if you find our advice is not correct.

PECULIAR BOILER ACCIDENT.

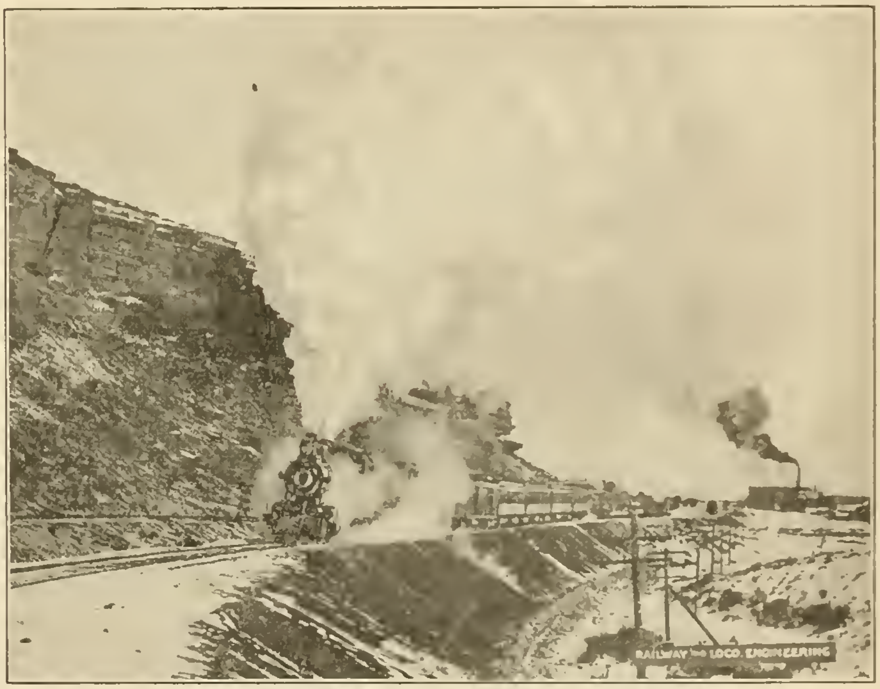
(103) W. S., La Junta, Col., writes:

A peculiar accident happened here while testing a boiler. A few flues were cracked and plugs driven in. About fifteen minutes after testing, when the pressure was entirely off, one of our men touched one of the plugs with his hammer and the plug flew out, and two men were badly burned, one of them being severely injured by being struck with the flying plug. My opinion is that the pressure in the flue was greater than the boiler pressure, thereby closing the crack. Would the same thing have happened if the boiler had been tested without firing up? A.—The pressure in the flue could not have been any greater than the highest pressure in the boiler, but when the steam pressure in the boiler was let off, the pressure in the flue had decreased at a much slower rate than the boiler, the pressure in the flue probably entirely closing the crack. The same thing would have occurred with a hydrostatic test, if the operation had lasted long enough to have allowed the cracked flue to fill up. The plugs should not have been disturbed so soon after the test.

THE NAME MOGUL.

(104) Student, Buffalo, asks:

1. What is the origin of the name "Mogul" applied to a locomotive? 2. Who was the first maker of that style of locomotive? A.—1. In a general way, the name Mogul was applied to mean something unusually powerful. The title Mogul was applied to the emperors of India. The greatest of these was Akbar, born October 14, 1542. He began to reign when he was but twelve years old, and over three provinces only, but he extended his empire over nearly the whole of India. His wisdom and justice earned for him the title "Guardian of Mankind." His Court at Agra was magnificent. Akbar's real name was Jelal-ed-Deen, but when he reached the height of his power he became known by the shorter name, which means very great, or greatest, and in English he was called the Great Mogul. He is said to have kept five thousand elephants, twelve thousand choice horses, and a thousand hunting leopards. Akbar died in 1605, was buried in a magnificent mausoleum near Agra, and was succeeded by his son. 2. Several locomotive builders tried a pair of carrying wheels in front of three pairs of coupled driving wheels, the wheel arrangement of the Mogul, but we believe that John Laird was the first to secure the pair of leading wheels in a Bissell truck.



A HARD PULL ON A FROSTY DAY.

GOOD SET SCREW AND SLACK KEY.

(105) J. R. B., South Chicago, asks:

1. What will cause the back end of main rod key to work loose with set screw in good condition?—A. This might happen if the key was quite slack laterally, especially if the key had a round back. Under such conditions the set screw tends to tighten the key against the brass by pushing in the key, away from its proper seat on the round back of the key-way. When the brass wears down it relieves the pressure and the key comes loose. Looseness from this cause cannot take place if the key is the proper thickness.

LINER BOUND BRASS.

2. What is meant by a brass being liner bound?—A. The term "liner bound" is applied to a case where the liner takes part of the pressure of the key of the brass, or where by reason of any irregularity, such as being taper, it forces the brass slightly away from the proper bearing on the pin. A liner may bind on the corners or it may be too short and cause the trouble.

LOCOMOTIVE VALVE BALANCE.

3. Does steam bear on the top of valve balanced or unbalanced all the time or not?—A. When steam is shut off there is no pressure on the valve. When the engine is working, if the valve is what is called "balanced," the pressure of the steam is applied only to the portions outside the valve strips. If the valve is unbalanced the steam pressure is exerted upon the entire area of the top of the valve. The inside admission piston valve is the most perfectly balanced valve in locomotive work.

DIRECT AND INDIRECT VALVE MOTION.

4. What is meant by direct or indirect engines? A.—This term is applied to

valve motions. Indirect motion is where a rocker arm pivoted about a point in the center is used. When one end of such a rocker swings, say to the east, the other swings to the west. This kind of a rocker causes the forward movement of the link block to produce backward movement of the valve. Direct motion is where the movement of link block and valve are always in the same direction.

BROKEN VALVE YOKE.

5. Please tell me some quick way to discover a broken valve yoke.—A. If the valve yoke is broken entirely off, the valve will be left on the front end of the stroke, and irregularities in the exhaust must be looked for, according to the type of valve, that is, inside or outside exhaust. If the yoke is cracked it will let the valve drag on the backward pull, and so be out of beat. On the push stroke it will be regular.

(106) C. S. D., Americus, Ga., writes: Can you tell me how high-speed tool steel should be worked to get best results? Sometimes our blacksmith hits it just right, but does not know what he does to it that time.

A. Overheating and overworking are the chief causes of failure in using tool steel. The heating should be uniform in a furnace if possible. When heated the work should be done rapidly, the hammer blows being lightened as the metal cools. In hardening, the heating should be uniform and as low as will give the required hardness. A tool is ruined if the heat be variable. High heat spoils the metal, changing the fine molecules into coarse, irregular, crystalline grains, which break readily. When hardening it should be cooled rapidly. Running streams are best for large tools. In tempering the heating should again be uniform and slow. It will be found that the tool brought slowly to the desired temper will stand more work than quickly tempered tools. Some kinds of steel are improved by being cooled in an air blast. Manufacturers generally furnish directions for using their special brands of steel. We may add that there is a tendency at the present time to run lathes and other machines at a speed perhaps higher than need be for the best use of fine tools. A deeper cut and slower speed would show better results.

The New York Elevated Railroad Disaster.

The immunity from serious disaster which characterized the running of the Elevated Railroad of New York for twenty-seven years, or as long as the road made use of steam locomotives, has been rudely changed since the introduction of electricity. Rear-end collisions have been painfully frequent, but the appalling tragedy last month of a car full of passengers falling from the structure with the resultant death of 12 persons, and 42 others seriously injured, marks a new epoch in metropolitan passenger traffic. The causes are not far to seek. Increase of speed, introduction of a large number of new and inexperienced men and the retention of old means and methods in new and complex combinations, have met with the inevitable result. The accident was of the most spectacular kind. Though the evidence so far is not conclusive, it appears that the motorman, Paul Kelly, who came into the service of the company during the recent strike, ran his train of six cars on to the curve at Ninth avenue and Fifty-third street, his signals set for Ninth avenue, while the signals at the curve were set for Sixth avenue, which is reached by a section on Fifty-third street. The report states that the signal man was absent from his post, but the signals were there and Kelly should have seen them in time to stop before coming to the switch. Instead, he kept on at a rate of speed said to be about fifteen miles an hour. The rate of speed allowed in taking the curve is eight miles an hour. Kelly evidently saw his mistake at some distance from the curve. He applied the brakes and the front car came to a full stop before completing the curve, which has a radius of one hundred and twenty-five feet. The train of cars buckled between the second and third cars at a point thirty feet before the second car had reached the switch, the impact of the third and succeeding cars being of sufficient force to push the rear truck of the second car off the track and continuing on their course, the second car was literally swept off the structure. The second car, after leaving the track, turned completely over sidewise and the end nearest the third car fell to the street, a distance of about twenty feet. The truck wheels in jamming over on the electrically charged third rail flashed into flames of blinding fire. When the second car had fallen into the street, the front truck of the third car left the track and fell over into the wreckage. The third car swung over, and, fortunately, struck into the window of an adjoining building, the passengers escaping through the window. The second car was nearly rent to pieces before it reached the ground. The bulk of the passengers fell in a heap in the end of the shattered car and the heavy truck of the third car with its motor attachments falling upon them was the chief cause of the casualties that ensued. The Board of Railroad Commissioners in their report, on September 23, holds that Paul Kelly, the motorman, who has disappeared, was chiefly to blame, but adds that the tower man, C. A. Jackson, also contributed to the accident. The equipment was said to be in good order.

Railway Rates in Europe and America.

Compilations made from foreign and domestic statistics show a freight rate on English roads of nearly two cents per mineral ton-mile. The actual figures are 1.93 cents. A ton-mile of merchandise or live stock costs 2.94, and on all commodities an average of 2.32. Against these the figures of the United States are startlingly small, being 0.58 cent. On German roads it is 1.42 cents; on French, 1.55; Austrian, 1.16, and Hungarian, 1.30.

England's passenger rates per mile according to the business magazine, on the same classes as there cited for the United States, were 4 cents, Germany's 3.8 cents. For their average day's wages workmen can travel as follows: American, 65 miles; British, 35; German, 53; French, 40; Belgian, 39; Italian, 38, and East Indian, 21.

On American roads locomotive engineers average $4 a day; English, $1.62; Belgian, $1.01; American firemen get $2.28; British, 91 cents; Belgian, 72 cents. Railroad laborers in the United States get from two to four times as much as laborers on foreign roads. Forty per cent. of the gross earnings of American railroads goes to labor, while only 25 per cent. goes to capital.

New Engines for the Clover Leaf.

The Clover Leaf Railroad has just placed an order with the American Locomotive Company for 15 locomotives of the consolidation type. They will be ready early in the winter, and will increase the number of engines in service on the Toledo-St. Louis line to 111. They will be used exclusively for freight service. Their weight will average 189,000 lbs; size of boiler 68¾ ins., with 322 flues 14 ft. 6 ins. in length; drivers 57 ins. in diameter. The size of cylinders are 21 ins. diameter by 28 ins. length of stroke.

The more sensible portion of the automobiling people in Europe are decidedly opposed to road racing and to the use of cars on common roads that can be speeded above twenty miles on hour. People are coming to believe that persons deficient in good sense with a fast motor under their command will always be a source of danger to all users of the highways. There is a strong public sentiment growing in favor of sending people to jail who have caused accidents by reckless speeding of motors.

In Germany locomotive engineers are said to receive a gold medal and $500 for every ten years of service without accident.

Air Brake Department.

CONDUCTED BY F. M. NELLIS.

Value of Best Brakes.

A railroad accident is an awful and lamentable thing, especially when attended with the horrors of burning wreckage, loss of life, and maiming of human beings who have entrusted their lives to the keeping of railway companies on whose train they select transportation. Foreigners have stood aghast at the apparent utter recklessness of American railroad practices, and we have grown in a measure to look upon them as a natural consequence of railroad transportation and a heritage of our system and methods, feeling satisfied that we are slowly but surely improving, as the loss of life statistics show, and that we are gradually diminishing our accidents per passenger mile.

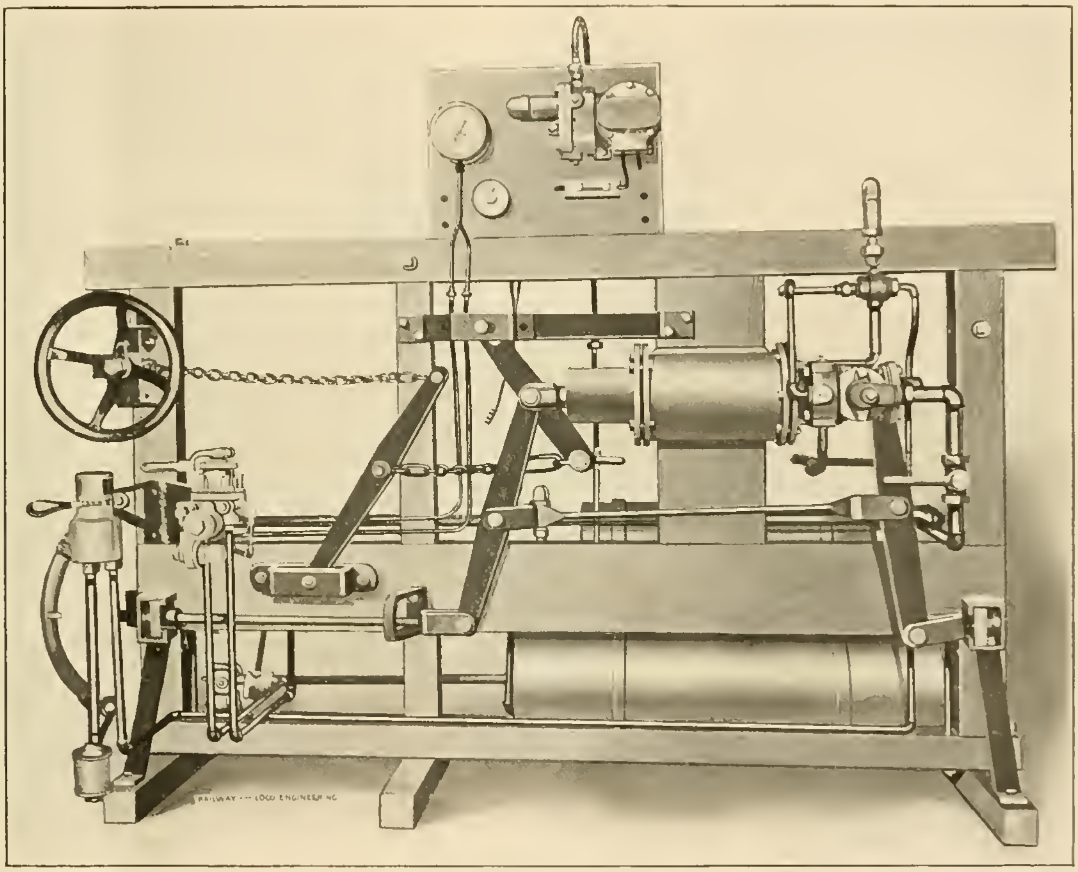
On our American railroads each fresh accident horror is met with submissive sorrow and honest but vain regret. Then follows the usual damage suits and settlement of obituary claims, railroad managers meanwhile realizing that such costs, if possible of elimination, would result in a striking evidence favorable to their management.

Yet, in the midst of it all, some do not see that much of the costs and many of the accidents could be averted if more attention were paid to brakes, both with respect to care of the present brakes and the availability of best brakes.

We are prompted to present the above facts for more serious consideration because of a recent accident on one of the prominent lines, whose traffic is dense, and train speeds high. A swiftly moving train had sudden and urgent need to stop on account of an open drawbridge. The stop was made, but not before the locomotive, with its brave sacrificing engineer, had toppled over and sunk to the bottom of eighteen feet of water. The first car overhung the drawbridge, so nearly balanced that it might have been shoved over by the pressure of the hand. The remaining several cars of the train, crowded with passengers, remained safely on the tracks of the trestle. The accident may be characterized as fortunate, as but one life was lost, whereas, under slightly different circumstances the entire train-load of passengers would have accompanied the brave engineer to death in the waters of the drawbridge.

A retrospection of conditions attending this accident is interesting. A year and a half ago the officials of the road, realizing that better and best brakes were obtainable, discarded a substitute high speed brake for a brake of superior type, and a real high speed brake was installed. The reorganization of the brake system cost many thousands of dollars to the railroad company, but in the above accident the best brakes proved their real value by saving the hundreds of lives in the passenger cars behind.

Not only has this accident proved in a mechanical way that best brakes have a superior value, but a confidence is imparted to the traveling public that such lines as the one above is prepared to care for its passengers' safety to the fullest extent that the brake manufacturers'



WESTINGHOUSE TRACTION BRAKE EXHIBIT AT ELECTRIC STREET CAR CONVENTION, SEPTEMBER 26, PHILADELPHIA PA.

skill can achieve. Apart from the deplorable death of the brave and sacrificing engineer, there is an absence of the usual lamentations and vain regrets, this being replaced by the secure and congratulatory feelings that all was done that could possibly be done by providing in the fullest measure best brake precautions for the safety of passengers.

A Duplex Brain.

The story is current that Mr. George Westinghouse, while playing a winning hand of whist at a social party one evening, worked out simultaneously the details of a gas meter which had baffled his ingenuity at other times.

This recalls an anecdote of Mr. Westinghouse on his trip home from the now famous Burlington brake trials in 1887. The disappointment at the failure of his trial 50 car freight train, equipped with the plain triple valves of that time, to perform satisfactorily had affected the inventor deeply, especially with reference to the severe shock on the rear end of the train, due to the slowness of the rear brakes going on, after the head brakes had applied.

He saw that a much quicker application throughout the train would be necessary to eliminate the shocks, and make the brake applicable to long train conditions. He also realized that whatever change was made, it must be of a kind that would work harmoniously with the brake then in service. The change in the system should not throw away the old triple valves, which must work harmoniously with the new triple valves, during the transition period, until a complete change could be effected and full benefits of the new brake be secured with the new valve.

Sitting in the car, these thoughts running in his mind, he was aroused by the superintendent of the road, who asked if he would not like to ride on the engine. He replied that he would, and at the next stop climbed up on the engine, and sat down on the forward end of the fireman's seat box, the superintendent sitting behind him.

Mr. Westinghouse gazed abstractedly at the rails ahead, evidently thinking hard on his air brake problem. The engineer, doubtless with mischief in his mind, called across the footboard:

"Come over here and make this stop. You can build brakes all right, but show us what you can do in making stops with them."

Mr. Westinghouse roused from his study, and the engineer persisted:

"Show us what kind of a stop you can make!"

Mr. Westinghouse took the engineer's seat and inquired:

"Where is the station—how far off?"

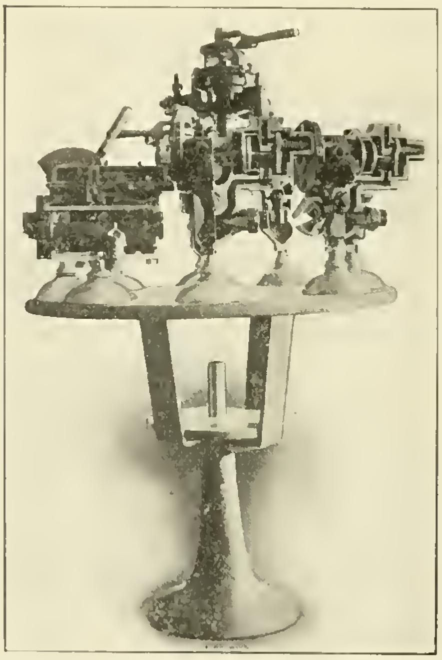
"Around that curve, on the right, about half a mile ahead. Better shut off now, and catch 'er up."

Mr. Westinghouse shoved the throttle lever in and grasped the brake valve handle.

"Better catch 'er up a bit," cautioned the engineer; "the tank's just around that curve, opposite the station. Don't let 'er get by!"

"All right," rejoined the air brake's inventor, as he struck the curve, "I see it now."

The engineer chuckled, for according to his calculation the train would slide by about three car lengths, and would have to be backed up, evidently to the decided discomfort of the presumptuous "tenderfoot engineer"; for hadn't he, great inventor though he was, the rankest kind of a cheek to tackle the most difficult stop on the road—a stop on a curve, and on a down grade, which not one of the regular engineers on the division made once in five times without "plugging" the engine, or using steam?



AN AIR BRAKE INSTRUCTION TABLE USED ON THE "FRISCO" ROADS.

Whether it was superior skill, good luck, or that the brakes knew their master, is not recorded, but it is said that the stop was made beautifully.

The fireman dropped the spout into the mathematical center of the manhole and stood gazing in open-mouthed astonishment at the unusual achievement, too bewildered to turn on the water until sharply reminded of that omission by the brakeman, who had come over to investigate the cause of the unusual phenomena.

With a light second application holding the train, reverse lever in back corner notch, to permit the engineer to "drop a bit o' oil on her links and eccentrics," Mr. Westinghouse sat gazing thoughtfully at the steam cylinder of the air pump, projecting above the running board, apparently oblivious to his splendid achievement, as the others saw it. To him more important things were transpiring.

Suddenly he awaked into activity, slid from the high seat box to the deck, and slapping the superintendent on the knee, exclaimed delightedly:

"Jones, I've got it—got it, sure! Can do it, too, with air pressure alone! Won't need electricity."

He hesitated and his eyes glowed under the inspiration of his new conception.

"And I'll put the train pipe air into the brake cylinder, too! I won't waste it! I'll make it do work, and there'll be no shock to the rear cars, either."

The engineer had finished his oiling and climbed up into the gangway. He had evidently had time to recover from his surprise and to prepare his little speech.

"That was a fine stop, sir; I couldn't have——"

"What's that?" interrupted the great inventor, the erstwhile "tenderfoot engineer."

"'Twas the best stop I ever saw made at that tank. Couldn't have done better myself, and not half as good two-thirds of the time."

"Oh, yes; that's so," was the rejoinder, "I did make the stop, didn't I? I was thinking of something else. Come on, Jones, let's get back."

Back in the car Mr. Westinghouse unfolded his scheme for venting train pipe air locally to each cylinder, thereby applying serially all brakes from head to rear end as fast, if not fster, than the slack could run in; and his scheme had been conceived while making the difficult stop at the water tank.

The New Westinghouse Quick Service Triple Valve.

Elsewhere in this number will be found a series of demonstrations made with the new Quick-Service triple valve as compared with the standard triple valve. We will give a brief description of this valve for the benefit of a number of correspondents requesting the same, but are unable at present to accompany the description with an illustration of this valve.

As the name implies, the valve gives a quicker service application than does the standard triple. Service applications are made with this triple valve similar in a measure to the emergency application of the standard triple valve, but in less degree. In other words, a train pipe reduction is made at the brake valve, which influences the first triple valve, and this valve takes into its brake cylinder a part of the train line pressure, making a reduction in the train pipe of the second car, which also takes a portion of the train line pressure into its cylinder, and so on serially throughout the entire train. In this way the rear brakes on a very long train are applied with an equal force and degree that the head brakes are applied, and in about the same time that an emergency application is made. Auxiliary reservoir pressure goes into the brake cylinder on top of the train pipe pressure already there, similar to an emergency application with the plain triple.

As the train pipe pressure is used in performing useful work of augmenting brake cylinder pressure, and not wasted by being thrown away to the atmosphere as usual, a five-pound reduction in the train pipe will give about as much braking power on each car as a fifteen-pound reduction with the standard triples. Also, all brakes are applied in service stop with equal force throughout the train, regardless of train length, as perfectly on the hundredth car as on the first.

In releasing, when main reservoir pressure is admitted from the main reservoir to the train pipe, the greater pressure in the head end of the pipe throws the triples on that portion of the train to the extreme release position, compressing a spring, and opening a small exhaust port for the escape of cylinder pressure. The pressure in the train pipe at the rear end of the train, being lower than that in the head end, due to the friction in the pipe, is not sufficient to drive the rear triples against the opposition of the spring, to extreme release position, where the small exhaust port is brought into play. When the spring is not compressed, or only partly compressed, a main or larger exhaust port is brought into play, which allows the brake cylinder pressure to escape more rapidly. In this way the rear brakes on a long train are released before those on the head end, thus doing away with the shock of the slack running out, which breaks the train in two, as it is now, by allowing the heavy engine and head portion of the train to lunge forward, the rear brakes remaining on, or tardily releasing, and anchoring the rear cars.

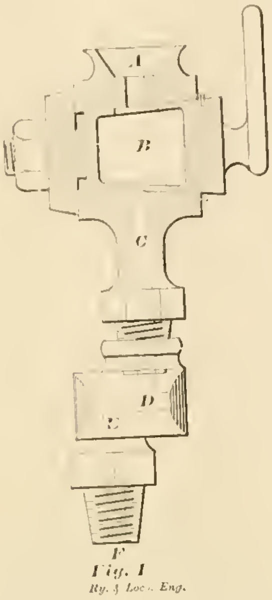
Fifteen to seventeen pounds train pipe reduction will apply the brake fully in service application and will give three to five pounds higher pressure in the brake cylinder than is obtained with the present standard triple valve.

In emergency applications the operation is practically the same as with the standard triple valve.

Oil Cup For Air Pumps.

The accompanying illustration shows an oiling device which I have been using with good success for some time past, and the men all like it.

Fig. 1 shows the cup ready to receive

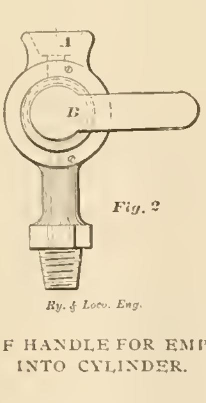


OIL CUP FOR AIR CYLINDER, WITH SPECIAL FITTING FOR CENTER PIECE.

oil, also screwed into a special fitting which I have made to accommodate the cup to the close quarters required by the 8 inch pump. The cup will generally screw into the 9½ inch pump without using the connection, and will go into 11 inch pumps without the connection.

I intend to arrange a connection so it can be easily attached to any pump without removing the key to do so.

Fig. 1 also shows the cup in position to receive oil, which is put in at the cup part *A*, passes then into chamber *B*, the hollow cavity in cock-key. By turning



POSITION OF HANDLE FOR EMPTYING OIL INTO CYLINDER.

down the handle the inlet is closed, and the oil is spilled through port *C*, *D*, *E* and *F* to the pump cylinder.

The cup so far has proven convenient, and an oil saver, the oil reaching the cylinder, none flowing back, as the stroke of the piston can't blow the oil out. It is simple in construction and operation. Simply fill the cup, then turn opening down.

R. N. Martin,
Penna. R. R.

Renovo, Pa.

An Air Brake Object Lesson—A Few Facts in Terms of Dollars and Cents.

Jennings had again been summed to his General Manager's presence, and as he entered the outer office he was greeted by both Burns, the chief clerk, and Phil, the office boy.

"Hello! Jennings," said Burns, "we haven't seen you for a coon's age. You've been off the carpet too long. The G. M. wants to rub off the rust and polish you up a bit."

"Bumps for yours, Mr. Jennings," said Phil.

To these greetings Jennings made the single rejoinder:

"Will the Boss see me?"

"Betcher life," said Phil, "and that's not all he'll do. Bumps, fine and dandy, for yours, Mr. Jennings."

"Go right in, Jennings," said Burns. "I'll have the ambulance ready for you when the green door swings outward."

Jennings pushed inward through the green swinging door and stood before the flat-top desk, behind which sat the General Manager, sphinx-like and severe.

"Jennings," began the G. M., "on your recommendation I equipped all our passenger trains with high speed brakes. We have had a lot of trouble on the "Blue Streak" and "Chain Lightning" from undesired emergencies and break-in-twos."

"Yes, sir;" replied Jennings. "But we have eliminated all that. I have rode with the engineers and they don't use steam any more until they are dead sure the hind brakes are off. We have installed a test plant with a "K" valve at each terminal that searches out the bad triples, and we have got away from that trouble. We keep the equalizing piston of the brake valve clean and well oiled, and they don't jump on the brakes any more like they used to. We are using a good grade of oil to lubricate the slide valves, and we have not had a single bit of trouble from this source for six months."

"Yes, that's true!" rejoined the G. M. "But that's not what I called you here for. It's about the accident at Lawrence, and I want you to explain why the train did not stop in time to save the '909' which cost me $18,000 not three months ago. You gave me to understand that high speed brakes would prevent accidents."

"Not exactly, sir;" replied Jennings, "not prevent all accident, but prevent a good many in which insufficient brake power cuts a figure. At Lawrence the further abutment span of the bridge washed out, and the stupid flag boy that the watchman sent back to flag the 'Chain Lightning' went off in the bushes picking blackberries, and the 'Chain Lightning' came around the curve, striking the bridge going fifty miles an hour, and as soon as he saw the red flag of the watchman the engineer shut off and applied his brakes. The train stopped on the brink of the missing span, the engine breaking her shackle and dropping off into the river, leaving the first express car hanging ready to topple over, if given a good healthy push. The engineer and fireman having done all they could to stop the train, rushed back over the coal pile and top of the tank, just in time to reach the toppling express car, as the engine shackle broke and let her drop 40 feet to the rocky bottom of the raging stream below. The engineer and fireman pounded on the end door and grew ten years older while waiting for somebody to come and let them in out of their dangerous positions, and when they reached the trestle they were too frightened to answer the quizzing of newspaper reporters and questions of the passengers. The fireman hasn't worked since."

"Yes," replied the G. M., "I'm told that the passengers were loud in their denunciation of the management that would bring them into an accident so close to death, and a vote was taken that managers who could not run their road better than that ought to be hung. But why didn't the high speed brakes stop that train, Jennings?"

"I believe, sir," replied Jennings, "that an exceptional good emergency stop was made in less than 1,000 feet. The train was running 50 miles an hour."

"That's all right, but what good did it do us to make that lot of tests a year or two ago that cost us about $20,000 and yet did not save us this $18,000 engine?"

"We lost the engine, but saved the train and passengers. Ordinarily we would have lost everything. The test taught us that the brake on the forward truck wheels of a locomotive will cut off easily 60 feet of the stop at 50 miles per hour on such a train. Sixty feet more and that express car would have been dangling in its place. That first express car contained five cages of lions and tigers from Barnum & Bailey's Circus, going into winter quarters at Bridgeport. Those animals are worth a lot of money, and would have brought from $1,000 to $5,000 each, especially if they were killed. That truck brake cost us $200, and saved the express car and at least $20,000 in wild animals."

"Whew!" whistled the G. M., "that's more than we paid for the engine. Cost of truck brake, $200; saved $20,000. That's one hundred fold. Good investment! Now that appeals to me when you put it in terms of dollars and cents. Go on. This is getting interesting. What else?"

Jennings continued: "Using the quick action triple valve on tender probably cut off 20 feet of the stop. This distance would save the second car, dangling over the water. The triple cost $15.00, and saved the car whose cost was about $3,000, or about two hundred fold.

"Another good investment," rejoined the G. M. "Go on."

"By using triple valves, which vented train pipe pressure to the brake cylinder, instead of wasting it to the atmosphere as the old triples did, gave us 10 per cent. greater braking power and reduced speed about 120 feet. This greater distance would have put the second baggage car over into the river on top of the engine, and two express cars, leaving the passenger cars on the bridge. The cost of changing the inferior triples to the superior type cost possibly $150, a saving in cost of baggage cars alone, aside from valuable contents, doubtless amounted to $8,000, or a saving of forty fold."

"Good! Go on."

"The high speed brake cuts off one-third of the ordinary stop. The half way substitute which we used to have—merely 90 pounds pressure in train pipe with no automatic reducing valve—probably cut off about one-sixth of the stop, say, or about 200 feet, or about three passenger car lengths. This would have dumped the café car, chair car and ladies' coach into the river on top of the engine, baggage cars and express cars, leaving the smoking cars alone standing on the bridge. The cost of high speed brakes on that train was about $200, but we can't compare it with the incalcuable saving of passengers' lives that were saved. I think that is enough to justify the expenditure of money we have made to equip our road with the best brakes obtainable."

"You're right, Jennings, and I want to thank you right here for the judgment you have used in the matter, and your success in overcoming the objections we all raised at the outset when you recommended better brakes. You may go."

As Jennings swung the green door outward and passed through the outer office, his bright eyes and flushed face betrayed to Burns the fact that an ambulance was not needed. As he passed through the outer door Phil called, facetiously:

"Good-bye, Mr. Jennings. Don't take any wooden money."

Inside the green door the G. M. was musing to himself:

"That young fellow, Jennings, is worth his weight in gold. He can show in terms of dollars and cents the saving he is making, not only in the matter of brake equipment, but in preventing loss of rolling stock and eliminating law suits."

Continuing, he muttered to himself: "If I had half a dozen officials as efficient in their positions as Jennings is in his, I would fire the rest of my whole official force to-morrow."

A Splendid Bargain.

We have secured a limited number of colored charts from the publishers of Blackall's Catechism, showing in eight colors both the passenger train equipment and freight train equipment. The passenger train, consisting of engine, tender and one car, shows all of the valves in section as well as the other brake parts; also the whistle signal system on these three vehicles. The freight chart shows in a similar way the parts common with the freight equipment. So long as these charts last we will send them to our readers at half usual rates. This includes one of the freight charts and one of the passenger charts, 13 ins. by 36 ins. in size, on fine paper for framing. Should be in every lodge room, instruction room and Y. M. C. A. Price, 50 cents, postage prepaid.

Unique Triple Valve Model.

A unique and serviceable educational device is found in the triple valve model designed and manufactured by Mr. W. Van Name, and as illustrated elsewhere in this issue. The triple valve model is made of hardwood, nicely finished and painted in colors, showing in section the inner working parts of the valve in the same manner as the more bulky and heavier metal valve usually employed. We cheerfully recommend this model to students and others in pursuit of air brake information. For sale at this office expressage prepaid, for $2.50.

One of the great railroad achievements during last month was the Erie securing control of the Cincinnati, Hamilton & Dayton System. Details are not worked out yet, but we understand that the C., H. & D. system will be managed as part of the Erie. When the organization is completed, it is expected that one of the officials of the Erie will be appointed general manager of the new lines.

The annual report of the New York, New Haven & Hartford Railroad shows gross receipts of $49,981,947. The operating expenses amounting to 71.7 per cent. of the total earnings. The New York & Ontario Company, largely owned by the New York & New Haven, showed gross receipts of over $4,500,000.

Thirteenth Annual Convention of the Traveling Engineers' Association at Detroit, Mich.

Detroit, Mich., having been chosen for the place of meeting of the thirteenth annual convention of the Traveling Engineers' Association, the members in goodly numbers, many of them accompanied by ladies, gathered at the Cadillac Hotel on the morning of September 12. That Secretary Thompson and his advisors have a happy faculty of prognosticating future weather conditions is apparent from the fact that the traveling engineers seldom if ever gather when the elements are not of a character to gladden the hearts, particularly of the ladies who come to the meetings with the intention of doing the town, whichever it happens to be.

Everybody knows Detroit makes strong claims of being a model convention city, that it has many attractions both within and without its limits, a beautiful river and the Cadillac Hotel, second to none as a convention entertainer. Promptly at 10 o'clock President Benjamin called the convention to order in a fine hall in the hotel set apart for the meetings and introduced Rev. Dr. Mockridge, who offered a fervent prayer.

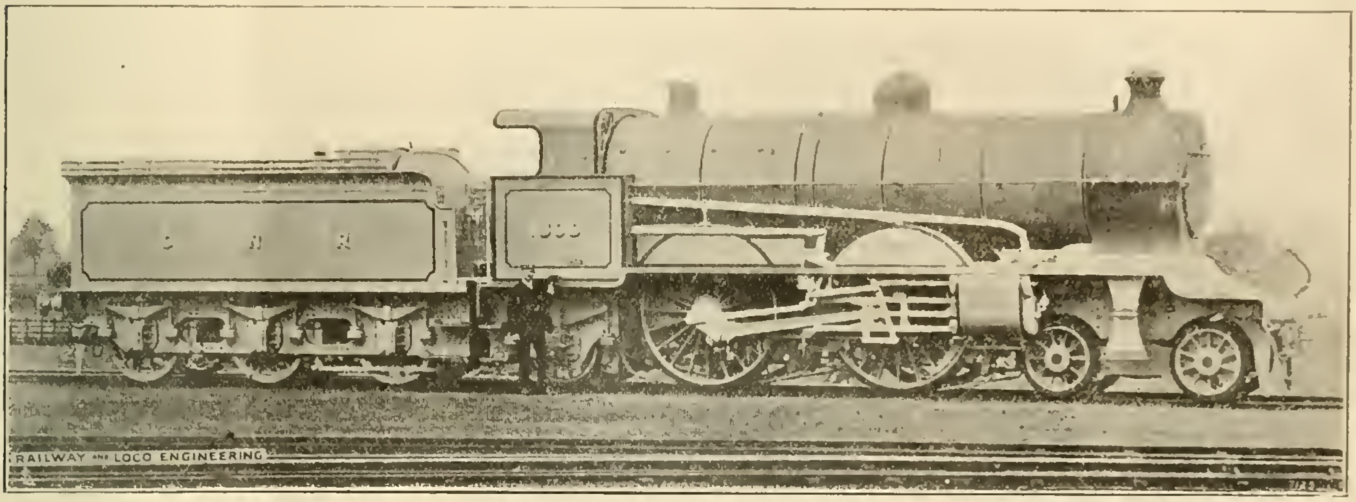
Mr. C. B. Conger then presented the president with a gavel, who followed with an able address. He referred to the last convention, then stated that his hearers were again together to take up the work mapped out at that time. Reference was made to the care and thought given by the committees in preparing papers to be read, and urged all to take part in the discussion. The importance was pointed out of co-operation of the traveling engineers with both the men under them and the mechanical officers; difficulties encountered with modern power as compared to the old; new devices; superheated steam; greater efficiency; application of mechanical stokers to locomotives as a step in the right direction, and concluded by referring to the satisfactory condition of the finances of the association and increased membership.

Following the delivery of the address the convention was duly declared formally opened and ready for business.

SECRETARY'S REPORT.

First came the reading of the secretary's report, after which a recess was taken both to permit the ladies to retire from the hall and give the members an opportunity to balance their accounts with the secretary. The report shows a most satisfactory state of affairs. September 1, 1904, there were 503 members. Since that time 71 new names have been enrolled and one member has been reinstated, making the present membership 575, with some thirty applications to be acted upon. Business being resumed, the treasurer's report was read and accepted.

No new or unfinished business being on the secretary's desk, an auditing committee was elected to perform the usual duties of such committee.



ATLANTIC BALANCE COMPOUND FOR GREAT NORTHERN RAILWAY OF ENGLAND.

Description on page 468.

THIRD MAN ON THE LOCOMOTIVE.

The first paper presented was one under the caption, "The Third Man on the Modern Locomotive." The conclusions of the committee were that "neither the men nor the company would be benefited by having the third man;" "the modern locomotive has not sufficient room for the third man;" "trouble detrimental to the service would ensue with two firemen;" "the hardship of a fireman is largely eliminated since his only duties are to put coal in the fire box;" "would make promotion slower, and as that is the one thing for which the fireman is striving, the procuring of good men would be difficult;" "with the third man on an engine where tried it had not proven satisfactory." The committee look for best results with one fireman, and, if necessary, shorter divisions for men firing heavy locomotives. Quite an animated discussion followed the paper, the consensus of opinion being that the third man was not necessary and that much could be done in the way of lightening the fireman's work by proper instruction from traveling firemen. The question was asked, Why have two firemen on an engine when the firemen themselves do not request it? The discussion was closed by a motion which was seconded and carried that each road and switch engine should have one engineer and one fireman.

At this stage of the proceedings a report of committees who attended the last Master Mechanics' convention, and which referred to the work of that convention, was read, accepted and ordered printed in the T. E. Association proceedings.

GREASE AS A LUBRICANT.

The second paper was entitled, Grease as a Lubricant. The committee believed, after investigation, that "grease as a lubricant on any but driving journals, main and connecting rod pins, is not economical or safe practice, and while it has been used as a lubricant for several years has only recently come into extended use on locomotive driving journal bearings, main and connecting rod bearings."

The committee believes oil a more natural and better lubricant for locomotive bearings than grease, but changing conditions incident to modern railroad methods, pooling of engines, etc., has led to the use of grease on driving journals and rod pins on all types of locomotives and classes of service.

Grease used as outlined above tends to reduce engine failure through offering more resistance to motion than does a fluid lubricant, but the committee is emphatic on the importance of "the clearance of the brasses on each side of the journal to prevent the scraping off of the lubricant," though "it has been found to be bad practice to give the main driving box brass too much clearance." A use of grease on any of the other bearings is opposed, and on driving journals and crank pins because these parts are the most difficult to maintain, due to the following reasons:

1. Driving journal bearings are exposed to high temperature radiating from the fire box and ash pan.

2. Careless handling of engines by ash-pit men.

3. Difficulty of removing and replacing driving box cellars on modern locomotives.

4. Waste settling from the journal, due to packing down and poor quality provided.

5. Neglect in putting movable plates on collars to prevent packing from working out.

The paper was very exhaustively discussed, both pro and con, the latter by the way being in a minority, and a motion was finally made and carried that the convention endorse the first and second opinions only of the committee.

TO LIGHTEN THE WORK OF ENGINEMEN.

The third paper read was, "What Devices for the Arrangement of Engine and Tenders Will Lighten the Work of the Engineer and Fireman?" and the committee had the following suggestions to offer: "Locomotives should be kept in the best possible condition at all times;" "should have a regular engineer and fireman if possible;" "firemen should do no cleaning on large engines;" "engineers on such engines should be relieved of the care of the wedges;" "suitable rest houses should be provided;" "cabs be provided with wing windows to protect eyes of engineers;" and many other suggestions, all tending to increase the comfort of the men. This paper, like its predecessor, was very thoroughly dealt with, many suggestions being made in addition to those proposed in the paper, and it was greatly in evidence that the members of the T. E. Association have very much at heart the subject of what should be done to lighten the work of the enginemen and increase their comfort.

PNEUMATIC SANDERS AND BELL RINGERS.

The second day's meeting of the association was called to order by President Benjamin at 9 A. M., and like the preceding one, was a lively session from start to finish. The last subject of the previous day was quickly disposed of, and paper No. 4, subject, "Pneumatic Track Sanders and Bell Ringers," was presented. The salient points brought out by the paper were that pneumatic sanders are considered a necessary part of the equipment of all locomotives regardless of their assigned class of service, and that for heavy engines it would be difficult to dispense with their use; that this device relieves the engineer and allows his attention to be given to other duties; the importance of knowing before starting out that the track sanders and appurtenances are in proper working condition; that they furnish sand at the critical moment and are at the same time sand economizers; that the quality and condition of sand must be given attention and that inside sanders are objectionable. During the discussion which followed many suggestions were made regarding the proper location of the sanders and size of pipes best suited for use in connection with them; troubles from moisture carried by the air; causes contributing to such moisture, etc., and how best to prevent the annoyance and possible stalling of trains from improper operation. The discussion very generally favored track sanders, but not to the exclusion of hand sanders, the latter at times being a valuable and needful adjunct.

During the discussion of this paper business was suspended for a short time, the president introducing Mr. J. B. Corlis, of the Michigan Lubricator Company, who in a pleasant and concise speech entertained the members.

LATEST MAKE OF LUBRICATORS.

Paper No. 5 was entitled, "The Latest Makes of Lubricators, Their Operation and Maintenance." The paper was a well prepared treatise on the subject, among the topics touched upon being the following: That modern lubricators are not radically different from those of earlier years and operated on the same general principle, though the points of difference in the modern cups should be understood in order to operate them correctly. The paper pointed out as the most radical change in late designs, the shape and location of the sight feed and register glasses and continued by calling attention to engine failures and injuries to enginemen by bursting of glass tubes in the old type of cups. This was attributed possibly to the higher steam pressure and temperature of modern locomotive boilers.

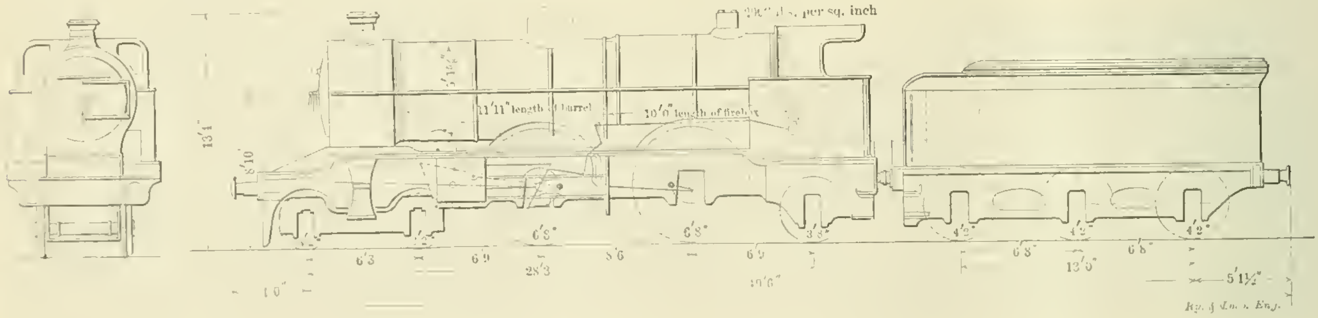
Among improvements was cited the reduced number of screwed joints and separate parts and a general tendency to simplify and make all parts to suit the hard service they receive; cups with four or more feeds for service on four-cylinder and cross compounds; larger steam pipes or equalizing tubes which are apparently necessary to maintain full boiler pressure in the oil pipes, and the steam supply should come from the steam dome direct, rather than from the turret. Sharp bends or pockets in any of the pipes is depreciated; oil must be kept free of small pieces of coal or waste; interior of cups should be kept clear of foreign matter and the condenser should be full of water before the oil feed is started. A discussion of the paper was indulged in, several lubricator representatives participating, and the subject had not been exhausted when adjournment took place for the day.

The third day's session opened at 9.45 Thursday morning, President Benjamin presiding.

The first business was the taking up of the paper under discussion when adjournment took place the preceding day, and the subject was finally disposed of by the following motion, which was adopted: "That the discussion be closed and subject carried over to 1906."

DESIGN AND LOCATION OF INJECTORS.

No. 6 being the next paper taken up, was read, followed by a very interesting lecture illustrated with numerous stereopticon views. Among the points emphasized in the paper were these: "That

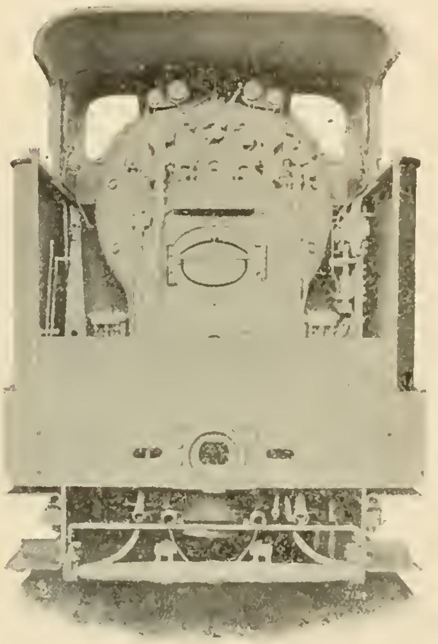


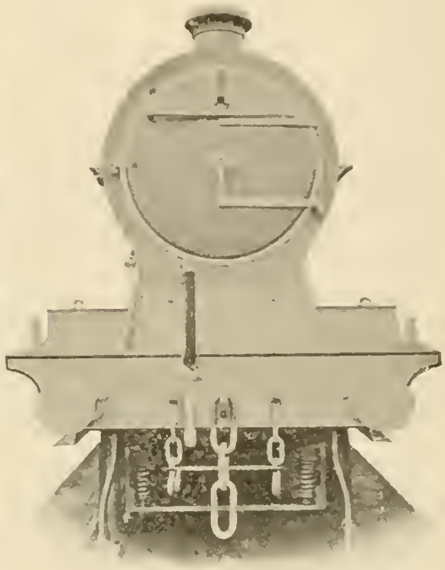
DETAILS OF GREAT NORTHERN OF ENGLAND LOCOMOTIVE.

during the last decade there has been considerable modification in the details of construction of locomotives and that this has been reflected in the design and location of injectors, this change having been caused partly by the increase in size of the boilers and partly by the effort to make each and every attachment of the locomotive more reliable and more convenient to operate;" that "all the efforts of the injector designer may be set at naught, unless there be proper co-operation on the part of the railroad officials and the locomotive builder;" "at high steam pressure the injector is more sensitive to height of lift and to increased temperature of water supply than at lower boiler pressures;" "that proper provision must be made that the water supply be led to the injector as easily as possible and with as little resistance both on account of the additional lift now required and on account of the increased duty;" "change in the boiler design which permits an added convenience in the location of injectors;" "good results of placing the injector on the back head of the boiler which permits the operating of steam lever and the water valve, or lazy cock, to be placed within easy reach of the engineer and fireman;" "the effect of lime and scale upon the operation of injectors;" "improvement in check valves," and "modern practice implies the use of the most approved devices." The discussion of the paper turned to water waste and methods of prevention; tendency of localizing the collection of foreign matter inside the boiler, when double check valves are employed; danger attending locating check valves on boiler head; advantage of locating check valve on top of the boiler; leaky valves in double check valves located on side of boiler and importance of vertical location of injector. The entire morning session was taken up with the paper until the lunch hour, when the convention adjourned until 2 P. M.

THE MECHANICAL STOKER.

Following adjournment, the next, or seventh, paper read was that entitled, "The Mechanical Stoker," and the deductions of the committee indicated the belief that "it was not necessary to mention the fact that the question of a locomotive stoker is one of the most vital before the railroad world to-day;" "from a mechanical standpoint as well as that of efficiency, no exception can be taken to the stoker, but to send one or two of them to a railroad and have them used by firemen unacquainted with the device was neither fair to the company nor the men operating them;" "they are applicable to both wide locomotive fire boxes and long fire boxes;" "maintain an even temperature which results in a marked effect on the cost of repairs to the locomotives;" "an engine coming into a terminal with a clean fire, such as is possible with this machine, eludes the clinker pit and dumping of fire;" "practical tests have proven that the stoker has a capacity of feed of 18,000 pounds of run-of-mine coal per hour" and "by relieving the fireman of the ordinary work of hand firing, the railroads are enabled to secure a class of men of more than ordinary intelligence to do the work of firemen," and in conclusion the paper states "there is only one thing necessary to make the mechanical stoker a success, and that is for the railway companies that adopt them to require the engineer and firemen to familiarize themselves with the construction and operation of the machine, which will largely guarantee it as both an economical and labor-saving device." The paper brought forth a warm discussion among several members who had tested stokers and who in the large majority of instances had found them economical in coal consumption when intelligently operated, and the belief appeared to be somewhat general that the device would be still further improved and in time become a recognized fixture.





GREAT NORTHERN OF ENGLAND LOCOMOTIVE.

SLIDE VALVE AND PISTON VALVE.

Paper No. 8, treating on "Slide Valve Versus Piston Valve," was the last one of the day and the main points presented in its reading were: "That the piston valve was not modern, having been used as long ago as 1833, and whether they are to become a fixture and force the D valve to the museum remains to be seen;" "which of the two types is doing the best work failed to be disclosed on inquiry;" "either badly designed will do poor work;" "the essential points to be considered in the piston valve over the slide valve are—cost, maintenance, steam distribution and fuel economy." Each of these were quite fully considered in the paper which stated facts and figures as such appeared to the writer, and the paper as a whole was a very able and fair argument of the subject.

In the consideration of the paper by the members many points were canvassed pertaining to it, and so very much was said relating to piston valves that space forbids repeating them here, though it was clearly evident that the subject was of great interest and the consensus of opinion favored the piston valve.

BREAKING IN TWO OF TRAINS.

The fourth and final day of the convention opened at 9 A. M., President Benjamin in the chair. The remaining paper for the consideration of the association pertained to air brakes and was entitled, "Breaking in Two of Long Trains, Passenger and Freight, at Low Speeds When Releasing Brakes, and Methods of Prevention." The leading points brought out in the paper were: "The causes of breaking in two when releasing brakes and difficulty, if not impossibility, of always preventing them, this being especially true of modern trains, both passenger and freight, since the weight of the cars has increased rapidly without a corresponding increase in the strength of the draft gear;" importance of the "engineers to realize that the brakes are capable of exerting shocks and pulls on the draft gear whose culminative effect when concentrated upon any particular coupling is several times as great as any pull the locomotive can exert;" "that the use of chokes or restrictions in the driver brake triple valve exhaust has proved an efficient preventative of break-in-twos, though in the use of these chokes it should be borne in mind that the proper manipulation of the brake valve, when releasing at slow speed, is of the utmost importance;" "that the rear triple on a passenger train of twelve or more cars cannot be expected to release simultaneously with those of the engine and forward cars, and why;" "proper method of handling the brake valve and operating the pumps to prevent breaking-in-two of long passenger trains and the importance of engines handling such trains being provided with large pump capacity;" how to handle the throttle when brakes are released at slow speed and a stop is not intended;" that "break-in-twos may be almost entirely prevented by proper instruction to engineers, coupled in some cases with a little wholesome discipline;" that "THE APPLICATION OF FRICTION DRAFT GEAR to modern car equipment is also a great help toward the elimination of break-in-twos;" that the old time "practice of kicking off brakes should never be indulged in with long passenger trains;" with long freight trains the instructions to "bring them to a full stop, before releasing the brakes cannot, the writer believes, be very well changed unless the locomotive is equipped with the combined automatic and straight air brake, and even with this equipment steam should not be used until all brakes have had time to release." The paper in closing calls the attention of the association to the benefits to be had from the use of the large air pumps when releasing brakes, also that "the better the condition of the general air brake equipment with respect to clean triple valves, uniform piston travel, tight packing leathers, tight brake pipes, hose and couplings, the greater will be the freedom from danger of breaking the train in two when releasing at any speed. During the discussion which followed, participated in by traveling engineers and representatives of air brake companies, the subject matter was discussed to quite an extent, though not exhaustively, owing to a lack of time.

LARGE PUMP CAPACITY.

The principal points covered during the discussion of the paper were the importance of large pump capacity regardless of whether one or two air pumps were employed on an engine; relation of the Interstate Commerce Commission laws to the question of one or two pumps; make-up of train as regards the location of new and old cars, empties and loads; the question of chokes or no chokes in driver brake triple valves was a somewhat mooted one, though not much discussed; advantages of providing passenger engines as well as freight and switch engines with straight air brakes; the methods of preventing break-in-twos of both freight and passenger trains, each of which were considered equally important; good results from stopping freight trains short of coal chutes, water cranes, etc., and detaching engine; and gradually improved brake conditions, also education of employees in matters pertaining to air brakes.

The discussion was once interrupted by the entrance into the hall of Detroit's chief magistrate, Mayor Codd, and the secretary of the Board of Commerce, both of whom made brief addresses of welcome, offered congratulations to the association and urged that it might again visit their city next year.

TO ADMIT ELECTRICIANS AS MEMBERS.

In the absence of the writer, (a member of the association) the secretary of the association read a paper urging the importance of having instructors for motormen on elevated and surface electric railroads by whom should be given instructions on both electric and air brake equipment, and in the discussion which followed in which the suggestions were favorably entertained, the members were urged to make efforts to familarize themselves with railway electrical appliances, as the future mechanical officers would be more and more brought in contact with the electrical field. Following considerable discussion on the advisability of admitting electrical men to membership in the association, the matter was disposed of by a motion that "Electricians of steam railroads and electric lines be accepted as members, the executive committee to decide who are eligible," and which was adopted.

The committee on changes in Constitution and By-Laws made a few recommendations of that character which the executive committee were instructed to incorporate.

A special vote of thanks was given to the committee of arrangements; numerous supply firms; various railroads and the Pullman company; technical press; retiring president; associate officers, with special mention of the secretary; authors of papers and the official stenographer.

NEW OFFICERS.

In the selection of officers of the association the following were unanimously elected:

President, A. L. Beardsley.
First vice-president, W. J. Hurley.
Second vice-president, A. M. Bickel.
Third vice-president, J. A. Talty.
Secretary, W. O. Thompson.
Treasurer, C. B. Conger.
Executive committee, G. H. Horton, C. F. Richardson, D. L. Enbank.

In indicating the choice of a place for holding the next annual convention three places were chosen, Chicago, Toronto and Denver, and it was left for the executive committee to determine at which place the 1906 meeting will be held.

WELL CONDUCTED CONVENTION.

The regular order of business now being concluded, addresses were listened to from Messrs. Curry, Hutchins, Talty, Conger, Hogan and Mast, among them being several charter members, and at the conclusion of the speaking the president's gavel fell, passing the thirteenth annual convention into the archives of history.

The convention was perhaps the most successful one in its history, going far to prove that 13 is not so unlucky a number as is too generally believed. The attendance was the largest, and that great interest was manifested is evidenced by the fact that at no time during the entire convention did the president have occasion to call on members to prevent the discussion of papers from lagging; in fact, that officer was compelled to declare the discussions closed in order to transact all the business there was to do in the time allotted for it.

An announcement by the secretary on the last day that the convention would adjourn with more than 600 members indicates the very gratifying increase during the past year.

ENTERTAINMENTS.

That the entertainment committee had been indefatigable in their efforts both before and during the convention was self-evident, to judge from the smoothness with which everything in the entertainment line passed off. Tuesday evening an imperial reception and ball concluded the day. Wednesday a somewhat early adjournment permitted the members to take a boat ride and dinner on Detroit river, and upon their return to the hotel a representative of the Gerlock Packing Company entertained them with a fine slight of hand and prestidigitateur performance, displaying in a highly creditable manner his proficiency in the "Black Art," which provoked much applause and enjoyment. Thursday evening everybody was highly entertained with vaudeville at the Temple Theatre. Last, but not least, the ladies were the special solicitude of the committee, and if they missed any of the attractions of the city it was a result of physical inability rather than inclination or lack of effort.

Fifteen new locomotives have just been added to the equipment of the Santa Fe Railroad. The new engines are made by the Baldwin Locomotive Works.

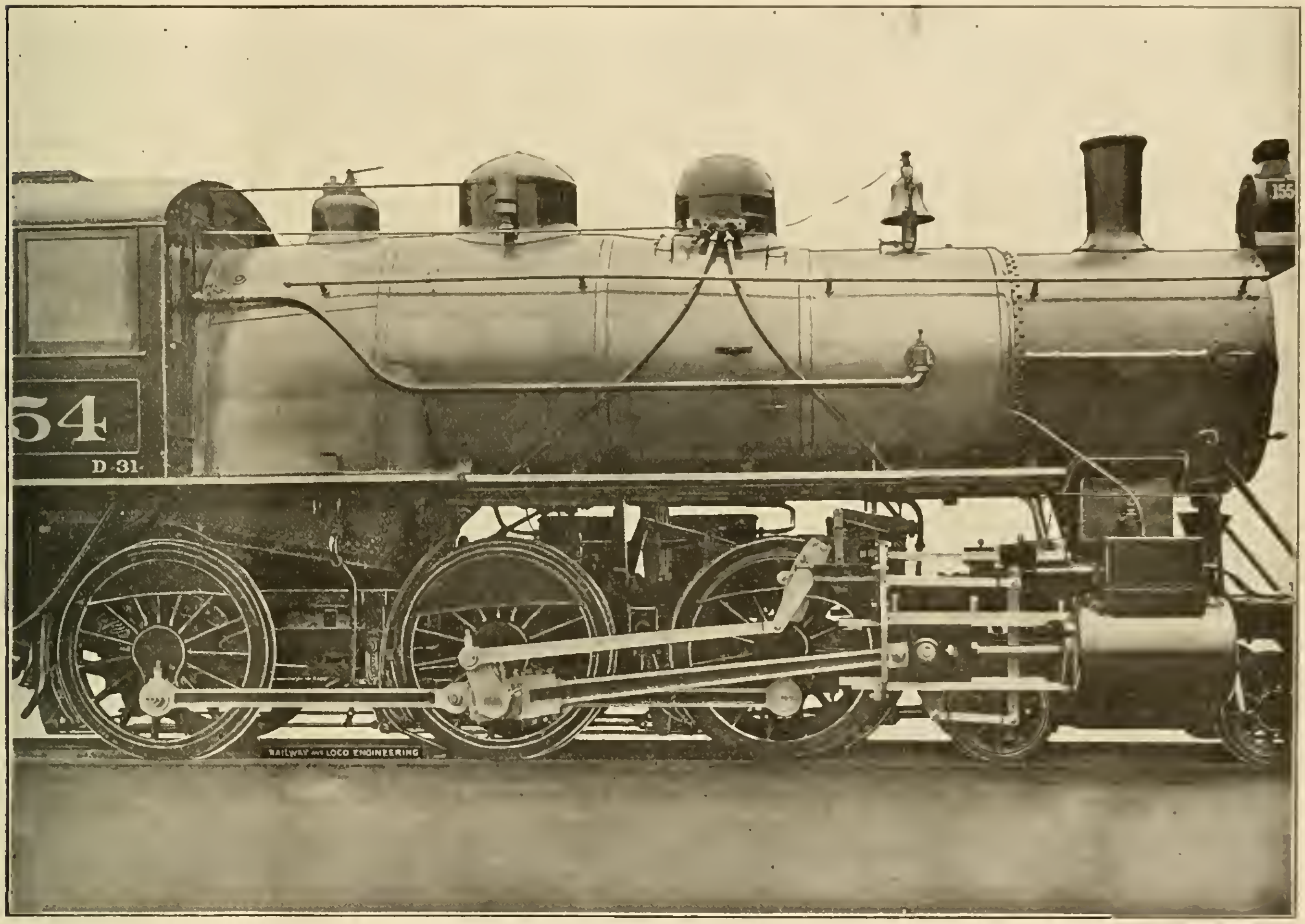
The annual report of the New York & New Haven Railroad shows gross receipts over $50,000,000. A dividend of 2 per cent. on $80,000,000 stock was declared for the quarter ending June 30. The net surplus exceeds $300,000. Improvements are on foot which will cost about $4,000,000.

Baldwin's Ten-Wheeler for Rock Island.

The rapid advances in recent years in locomotive construction has brought several excellent types of engines into use, and in the widening field of fast freight traffic the proportions of the locomotives have been advanced to an extent unknown in other countries. It has been thoroughly demonstrated that the employment of locomotives of such size and power has been made with due regard to economy. The American builders have been peculiarly fortunate in developing types of powerful fast freight engines that are coming into great popular favor especially in the long distance roads in the West.

With regard to size it may be said that the leading gauge in America permits a locomotive being built having a height from rail to top of smokestack of nearly, if not actually, 16 ft. In Great Britain the height is limited to 13 ft. 6 ins., while on the Continent of Europe it approaches 14 ft. 6 ins. The American builders thus have an advantage in height, with a corresponding advantage in width, of which they have taken due advantage so that boilers and cylinders are beyond the reach of European builders.

The accompanying illustration is a fine example of the 4-6-0 type constructed by the Baldwins for the Chicago, Rock Island and Pacific Railway Company. It embraces all of the leading improvements in detail of construction, including the Walschaert valve gear, which is rapidly coming into use in America, and may be said to be the only radical change in locomotive construction that has come from Europe in many years, the fact being that engineers in other countries are accustomed to look to America for nearly all improvements in modern locomotive building.



4-6-0 FOR THE CHICAGO, ROCK ISLAND & PACIFIC.
T. S. Lloyd, General Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

The boiler is of the wagon top variety, with a diameter of 68 ins. in the front ring, the thickness of the steel sheets being 11/16 ins. and ¾ in. The staying is of the radial kind, calculated to a working pressure of 200 lbs. The fire box is also of steel with sides, back and crown ⅜ in. in thickness, the tube sheet being 9/16 in. thick, and is adapted for burning soft coal. The dimensions of the fire box are 96 ins. in length by 67 ins. in width, with a depth at the back of 58 ins. sloping 14 ins. downward to the front of the fire box. The water space in front, sides and back is 4½ ins. The tubes are of No. 11 wire gauge, charcoal iron, 329 in number, 2 ins. in diameter, 14 ft. 2 ins. in length. The total heating surface is 2,586 sq. ft.

The cylinders are 22 ins. in diameter by 26 ins. in length, the slide valves are of the balanced type. The driving wheels have an outside diameter of 63 ins., the main journals being 10 ins. by 12 ins., the other 9 ins. by 12 ins. Diameter of truck wheels 30½ ins. with axle journals 6 ins. by 12 ins. The driving wheel base measures 15 ft., the total engine wheel base being 26 ft. 6 ins., the extreme length of engine and tender amounting to 56 ft. 5½ ins. The weight on the driving wheels is 131,200 lbs.; on truck, 42,520 lbs.; the total weight of engine and tender is estimated at 304,000 lbs. The tank has a capacity of 7,000 gallons of water and 12 tons of coal. The total tractive power of this type of engine approaches 40,000 lbs., giving a coefficient of adhesion of 4.35. This type of engine is admirably adapted for long distance freight service.

The Illinois Central will spend $300,000 in enlarging its present shops at Burnside and making that town the main building and repair point of the entire system.

Atlantic Compound for Great Northern Railway of England.

(*Illustrated on pages 463-465*)

As a rule British locomotive superintendents are very conservative in adhering to the accepted types of motive power and changes are seldom made without deliberate consideration. Railway men of other countries have commented upon the reluctance displayed by British railway men in making use of the compound principle in their locomotives, and the answer has been, "we see no advantage in using compound locomotives; most of the men who have tried compounds have given them up."

The undoubted success of the "Atlantic" type of balanced compound in France and in the United States has moved various locomotive superintendents in the British Isles to find out by practical experience how the balanced compound will compare with the admirably designed simple express locomotive which continues to maintain enviable popularity on the other side of the Atlantic.

Among the locomotive superintendents who have decided to put the balanced compound to the test of train service is Mr. H. A. Ivatt, of the Great Northern Railway of England. We here present four engravings showing an engine of this form, the designs of which were worked out by Mr. Bodmer of the *Model Engineer*, since deceased, from specifications provided by Mr. Ivatt. Although only one of these engines has been built, we feel justified in putting it before our readers because it is attracting great attention in Great Britain and is looked upon as the type of the future express locomotive.

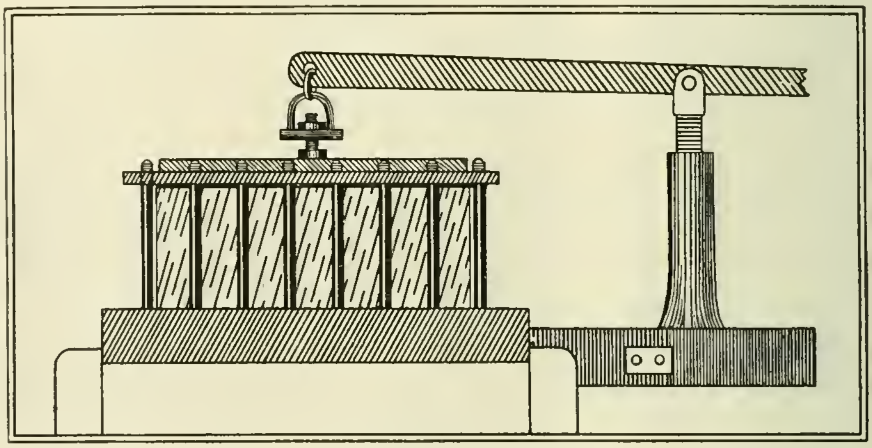
The leading dimensions of the engine are: cylinders, 14x23 in. by 26 in. stroke; driving wheels, 80 in. diameter, carrying about 84,700 pounds. The total weight of the engine in working order is about 160,000 pounds. Total wheel base, 28 ft. 3 in. Traction power, 21,000; coefficient of adhesion, 4.

As will be noticed, the boiler is straight and is very large for a British engine. It is 61⅝ in. outside diameter, the tubes are 11 ft. 11 in. long, providing 2,344 sq. ft. of heating surface, while the fire box provides 170 sq. ft. more, making a total of 2,514 sq. ft. The fire box is 10 ft. long and has 31 sq. ft. of grate surface. Boiler pressure 200 pounds to the square inch. No advantage is taken of the facility for spreading the fire box over the frames, as is usually done with Atlantic type locomotives, the necessity for keeping the engine short enough for the turn tables causing the designers to forego this valuable feature.

The engineers under Mr. Ivatt are making exhaustive tests of this engine, and we shall try to advise our readers of the results. We do not, however, consider the results of tests of a new locomotive of much importance. What it will do when hard service has worn divers parts away from original dimensions, and how many hours the engine has been in the repair shop as compared with a simple engine during 200,000 miles train hauling would make a more valuable basis of comparison than any number of so-called scientific tests.

Steam Chest Lifter.

Mr. W. S. Buchanan send us a sketch of a device for lifting the covers of steam chests, which is in operation at the railroad repair shops in Urbana, Ill. As will be seen from the accompanying sketch there is a link in the end of the lever to hang a staple with plate riveted to it, with a hole in the center of the plate to slip over the oil plug in steam chest cover. The lever is attached to a fulcrum which rests on the front end of the engine. The lever may be made as long as can be conveniently used between the front of the engine and the roundhouse wall. The nut used in holding down the steam chest casing can be used to hold the plate. Considerable difficulty is often experienced in raising the covers of steam chests and the difficulty is increased by leaking throttles. With this readily adjustable lever the operation may be rendered comparatively easy.



STEAM CHEST LIFTER.

Combination Railroad Car.

"Columbia," a combined sleeping, dining and parlor car of the American Palace Car Company, was recently examined at Camden Station by a number of capitalists, railroad men and travelers. For their benefit it was shown how easily the interior, exhibited as a parlor car, in a few minutes could be converted into a dining car and then into a most comfortable sleeper.

The kitchen is much like that of the regular diner, but the main apartment, while it appears the same, is almost entirely different.

Upon entering the car one sees no sign of berths, but a porter, with an auger-like tool, lifts a swinging door in the floor and placing the tool in a lock turns it rapidly. Then come into view two bed-like boxes, which rise, one above the other, and are automatically locked; curtains are thrown into position, the covers turned back and the berths are ready for occupancy. Each berth is the full size of a single bed and has a comfortable, springy mattress. There is much more space between the berths and also a wider aisle than in the ordinary sleeper.

After the berths are again lowered beneath the flooring of the car the chairs, which have been taken from beneath the lower berth, are again placed in position, and at the proper time tables are put in position, and what are apparently mirrors are swung open, revealing the silver for each table snugly packed away.

Demand for Mechanical Stokers.

The Westinghouse Machine Company have received a larger number of orders for the Roney Mechanical Stoker this year than they have received for the corresponding period of any other year since they began the exclusive manufacture of the article. The successive improvements have enabled them to produce a machine that meets all the requirements of heavy modern service.

Fifty-one orders were received last month, the largest order being from the Pennsylvania Railroad for six 132 ins. by 36 ins. grate stokers, and five 100 ins. by 20 ins. grate stokers. The Baltimore & Ohio office building in New York city is also being equipped with the Roney stoker.

The horse is perhaps the only animal known that doesn't breathe through its mouth—it breaths through its nostrils only.

Of Personal Interest.

Mr. O. O. Winter has resigned as division superintendent of the Canadian Pacific at Fort William, Ont., Can.

Mr. E. Madden has been appointed road foreman of engines of the Southern, with headquarters at Selma, Ala.

Mr. W. S. Tinsman has been appointed president of the Arkansas Southern, with headquarters at Little Rock, Ark.

Mr. F. S. Lewis has been appointed superintendent of the Southern Indiana, with headquarters at Terre Haute, Ind.

Mr. James F. Parr has been appointed assistant engineer of the Missouri Pacific with headquarters at St. Louis, Mo.

Mr. N. J. O'Brien has been appointed general manager of the Panhandle & Gulf, with headquarters at Sweetwater, Tex.

Mr. W. J. Raef has been appointed general manager of the Texas Southeastern, with headquarters at Diboll, Tex.

Mr. George J. Kobush has been chosen vice-president of the Mobile, Jackson & Kansas City, with headquarters at New York.

Mr. C. O. Tulloch has been appointed general foreman of shops of the Central of Georgia, with headquarters at Savannah, Ga.

Mr. J. H. Harris has been appointed general superintendent of the Midland Valley, in charge of maintenance and operation.

Mr. G. P. Troutman has resigned as assistant division engineer of the Lehigh Valley, with headquarters at Centralia, Pa.

Mr. E. W. Dickson has been appointed general superintendent of the Paris & Great Northern, with headquarters at Paris, Tex.

Mr. E. J. Chamberlin, formerly general manager of the Canada Atlantic, has been appointed president of the Morelia & Tacambaro.

Mr. C. B. Sumers has been appointed road foreman of engines of the St. Louis division of the Toledo, St. Louis & Western.

Mr. W. A. Mitchell has been appointed master car builder of the Missouri, Kansas & Texas, with headquarters at Sedalia, Mo.

Mr. R. Mallen has been appointed road foreman of engines of the Baltimore & Ohio Southwestern, with headquarters at Chillicothe, O.

Mr. H. M. Atkinson has been elected president of the Atlanta & Birmingham, at Atlanta, Ga., to succeed Mr. W. G. Raoul, resigned.

Mr. Charles H. Hix has been appointed general superintendent of the Seaboard Air Line, with headquarters at Portsmouth, Va.

Mr. J. F. Graham has been appointed superintendent of motive power of the Columbus Southern, with headquarters at Portland, Ore.

Mr. J. F. Cook has been appointed terminal trainmaster of the Baltimore & Southeastern, with headquarters at Cincinnati, Ohio.

Mr. C. J. Bushmeyer has been appointed acting master mechanic of the Denver, Enid & Gulf, with headquarters at Enid, Okla.

Mr. Chas. Montgomery, traveling engineer on the Missouri Pacific, has resigned to accept a similar position with the Pere Marquette.

Mr. M. W. Wells has been appointed general manager of the Chicago Southern, with headquarters at Grand Central Station, Chicago, Ill.

Mr. C. M. Jones has been appointed division superintendent of the Chicago, Rock Island & Pacific, with headquarters at Dalhart, Tex.

Mr. George Geiger has been appointed assistant superintendent of the Fort Worth & Denver City, with headquarters at Childress, Tex.

Mr. V. A. Riton has been appointed superintendent of the Norfolk division of the Norfolk & Western, with headquarters at Crewe, Va.

Mr. J. H. Eaton has been appointed master car builder of the western lines of the Canadian Pacific, with headquarters at Winnipeg, Man.

Mr. A. W. Nelson has been appointed division foreman of the St. Louis & San Francisco, with headquarters at Beaumont Junction, Kan.

Mr. C. E. Rowe has been appointed assistant engineer of the Southwest System of the Pennsylvania lines, with headquarters at Pittsburg, Pa.

Mr. W. S. Becker has been appointed superintendent of the Pocahontas division of the Norfolk & Western, with headquarters at Bluefield, W. Va.

Mr. W. R. Baker, formerly assistant to the vice-president of the Canadian Pacific, has been appointed assistant to the president of the same road.

Mr. E. M. Grime has been appointed division engineer of the Chicago Great Western, with headquarters at St. Paul, Minn., to succeed Mr. H. W. Church.

Mr. L. U. Morris, formerly division superintendent of the Atchison, Topeka & Santa Fe, has been appointed superintendent of the El Paso & Southwestern.

Mr. H. H. Hab has been appointed assistant master mechanic of the Grand Rapids district of the Pere Marquette, with headquarters at Grand Rapids, Mich.

Mr. J. C. Collins, formerly trainmaster of the Southern Indiana, has been appointed superintendent of the Illinois Southern, with headquarters at Sparta, Ill.

Mr. G. L. McDougald has been appointed signal engineer of the Chicago & Alton, with headquarters at Bloomington, Ill., to succeed Mr. W. R. Davis, resigned.

Mr. Hugh Wilson has been appointed superintendent of the White River division of the St. Louis, Iron Mountain & Southern, with headquarters at Aurora, Mo.

Mr. F. B. Archibald, formerly with Messrs. Berry Bros., Ltd., of Detroit, has accepted a position as representative for the National Lock Washer Co., of Newark, N. J.

Mr. J. G. Sullivan, engineer of construction on the western lines of the Canadian Pacific, has resigned to become assistant chief engineer of the Panama Canal.

Mr. H. K. Mudd, formerly general foreman of the Wabash, has been appointed district master mechanic of the Missouri Pacific, with headquarters at Little Rock, Ark.

Mr. C. A. Strom, formerly mechanical engineer of the Isthmian Canal Commission, has been appointed superintendent of motive power and machinery of the Canal Commission.

Mr. H. B. Hunt, who recently resigned as assistant mechanical superintendent of the Erie, has become general inspector with the American Locomotive Co., at Schenectady, N. Y.

Mr. W. H. Bush, assistant engineer of the Missouri Pacific, has resigned that position to become engineer of maintenance of way of the Kansas City Southern, with headquarters at Pittsburg, Kan.

Mr. J. M. R. Fairbairn has been appointed acting division engineer of the eastern division of the Canadian Pacific, with office at Montreal, Can., succeeding Mr. D. MacPherson, who has resigned.

Mr. James Kurn, formerly trainmaster of the Atchison, Topeka & Santa Fe at Las Vegas, N. M., has been appointed division superintendent of the same road, with headquarters at San Marcial, N. M.

Mr. J. F. Emerson, a prominent member of the Brotherhood of Locomotive Engineers, at Macon, Ga., has been appointed road foreman of engines for the Macon division of the Central of Georgia Railroad.

Mr. L. J. McIntyre, formerly engineer of the New York terminal division of the Erie, has been appointed an assistant engineer of the Chicago & Northwestern, with headquarters at Chicago, Ill.

Mr. J. W. Leonard has been appointed general superintendent of transportation of the eastern lines of the Canadian Pacific, with headquarters at Montreal, Can., to succeed Mr. C. W. Spencer, resigned.

Mr. F. H. Riley has been appointed general foreman of roundhouse and repair shops of the Chicago & Eastern Illinois, with headquarters at Terre Haute, Ind., to succeed Mr. Curtis A. Weiser, resigned.

We are advised that Mr. Charles J. Thompson, who formerly represented the Hendrick Mfg. Co., of Carbondale, Pa., as manager of their New York office at 149 Broadway, is no longer connected with the company.

Mr. R. H. Lanham, an engineer on the Missouri Pacific, has been chosen to fill the position of traveling engineer on the same road. His many friends will be pleased to note his appointment and offer congratulations.

Mr. W. L. Hope has been appointed trainmaster of the Dakota division of the Chicago, Rock Island & Pacific, with headquarters at Estherville, Ia. Mr. Hope was formerly division engineer of the Rock Island system.

Mr. Walter Hale, heretofore superintendent of the Seaboard Air Line, at Savannah, Ga., has been appointed superintendent of the same road, with headquarters at Jacksonville, Fla., to succeed Mr. H. B. Grimshaw.

Mr. George H. Burgess, assistant engineer of the Northwest system of the Pennsylvania lines West, has been appointed assistant engineer of the Erie. Mr. Burgess will have charge of the Jersey City terminal improvements.

Mr. C. W. Spencer has been appointed general manager of the Canadian Northern lines east of Fort William. Mr. Spencer was until recently general superintendent of transportation on the eastern lines of the Canadian Pacific.

Mr. Thomas J. Tonge has been appointed master mechanic of the Zuni Mountain Railway, with headquarters at Thoreau, N. M. Mr. Tonge was formerly roundhouse foreman of the Atchison, Topeka & Santa Fe Coast Lines.

Mr. W. A. James, formerly assistant engineer of the Canadian Pacific, at Kenora, Ont., has been appointed division engineer of the same road, in charge of grade revision and double-track work on western lines east of Winnipeg.

Mr. A. S. Grant has been appointed master mechanic of the Missouri division of the Missouri Pacific, with headquarters at De Soto, Mo., vice Mr. W. J. Haynen, resigned, to take position as superintendent of motive power on the Detroit, Toledo & Ironton Ry. Co.

W. P. APPLEYARD.

Mr. Joseph Lindley has been promoted from passenger engineer to be road foreman of engines of the Pere Marquette system, with headquarters at Ionia, Mich. Mr. Lindley has been very popular among his fellow trainmen, and is certain to make a success as traveling engineer.

Mr. G. B. Obey has been appointed superintendent of the Monongahela, with headquarters at Brownsville, Pa., to succeed Mr. John Ermire, resigned. Mr. Obey was formerly superintendent of the Monongahela and Youghiogheny division of the Pittsburg & Lake Erie.

Mr. C. L. Barnaby, formerly assistant engineer maintenance of way of the Chicago Terminal division of the Grand Rapids & Indiana, at Chicago, has been promoted to engineer of maintenance of way of the southern division of the same road, with headquarters at Fort Wayne, Ind.

Mr. P. J. Harrigan, general foreman of the Baltimore & Ohio shops, has been appointed master mechanic of the same road, with headquarters at Connellsville. Mr. Harrigan has been in the employ of the Baltimore & Ohio for 37 years, and the promotion is well merited. Heretofore there has been no master mechanic at Connellsville, and the duties of general foreman will be consolidated with those of master mechanic.

Mr. M. E. Wells has been appointed traveling master mechanic of the Wheeling & Lake Erie, with such special duties as may be assigned to him from time to time. In the circular announcing the appointment Mr. Wells' duties are defined as follows: "For the present Mr. Wells will have general supervision of roundhouse service, the care of locomotive boilers on the road and at terminals, the character of the water supply, etc. He goes out not to find fault or criticise, but to assist all concerned in getting better results."

Mr. Oscar Tyler, a locomotive engineer from Cleveland, and a member of Division 31 of the Brotherhood of Locomotive Engineers, has served a term in the Ohio Legislature, and is a candidate for re-election at the November election. Mr. Tyler has been a very faithful and efficient member of the Legislature, and deserves to be re-elected We trust that the railroad men in his district will combine together to see that this worthy man goes back to work in the interests of railroad men in a legislature where his services are very much required.

Mr. G. M. Basford, for many years editor of the *American Engineer and Railroad Journal*, has been appointed by the American Locomotive Company as head of their new department of publicity. Mr. Basford is an accomplished and scholarly writer on engineering subjects and the American Locomotive Company are fortunate in securing his services. He assumes his new duties on October 1 at the general offices of the company, 111 Broadway, New York. Mr. Basford has the good wishes of all who have the honor of his acquaintance.

Death of Mr. William P. Appleyard.

Railroad men generally will be greatly grieved to hear of the untimely death of William P. Appleyard, superintendent of construction of the Pullman Company, the sad event occurring at Chicago on September 19. From the reports that have reached us, it appears that he had gone to meet his wife at the Thirty-ninth street station of the Illinois Central Railroad, and, finding that the train was late, he proceeded along the tracks to the Sixty-third street station, and was struck and killed by another train.

Mr. Appleyard was very popular among railroad men. He graduated from Notre Dame University in 1874, and was engaged in engineering work on the Capitol building at Lansing, Mich. He engaged in the practice of engineering and architecture until 1889, when he went to the Pullman Company as mechanical inspector, later becoming superintendent of repairs. In 1895 he became master car builder of the New York, New Haven & Hartford Railroad, where he remained until February, 1904, at which time he returned to the Pullman Company as superintendent of equipment. He was closely identified with many of the railway and manufacturing associations and was elected president of the Master Car Builders' Association at Saratoga, in June, 1904.

Mr. F. W. Cox, formerly master mechanic on the Chicago, Milwaukee & St. Paul, has been appointed assistant works manager of the Westinghouse Electric and Machine Co., Pittsburgh, Pa.

A new candidate for the favor of readers has reached our desk in the shape of the Maple Leaf Bulletin, published by the employees of the Chicago Great Western Railway, at St. Paul, Minn. They start out with a picture of President Stickney as a frontispiece, and fill up 32 pages of the small standard size with very readable matter. The publication is well edited under the control of Messrs. J. H. Sayle, T. M. Flynn, and J. F. Richards.

Theory of the Origin of Life.

Editor:

I thank you for your courtesy in sending me a copy of your journal for June, containing a note on my theory of the Origin of Life. In a subject so abtruse it is easy to be misunderstood, and I am not surprised to find that the writer of your note has inadvertently given a wrong impression of my meaning, when he says: "One of Dr. Allen's theories is that cells of vital life may be produced by the deoxidation of compounds containing nitrogen, oxygen, carbon and hydrogen by the action of light, heat and electricity. . . ."

Allow me to say emphatically that I don't suppose cells could be produced by any such simple process. It is true that I regard this form of deoxidation as the most fundamental function of living substance; it is the most prominent function now, and was probably the most prominent at the very beginning of life. But we can hardly suppose that the beginning of life was a cell; it must have been something immensely simpler.

You have probably seen a letter from me on the Origin of Life in *Nature* for November 17, 1904. If you have leisure to refer to it again, you will find the following words:

". . . the cell is a very complex organism, and between inorganic substance and the cell there may have been as long a course of evolution as between the cell and the highest existing animal or vegetable."

Since the opinion which your note attributed to me is manifestly absurd, I should be much obliged if you could kindly insert a correction in your pages. Such a correction would not only be an act of justice to me; it would also safeguard your readers against the effects of a piece of false science.

F. J. Allen.

[This letter ought to have appeared in our August issue, and was by mistake filed among copy intended for the inspection of the editor.—Ed.]

The proceedings of the Association of Transportation and Car Accounting Officers has just been published, giving a full account of the transactions of that body at their meeting in Toronto, Canada, last June. It forms a bulky volume of 222 pages, and contains much matter of importance to all interested in railway transportation, especially in freight traffic. The work is published by the Railway Equipment and Publication Company, at 24 Park Place, New York.

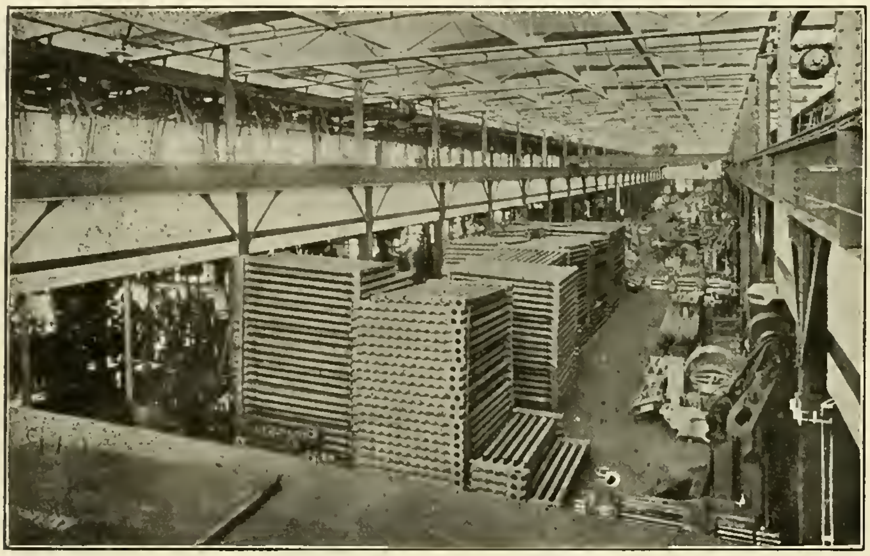
The seventy-second annual report of the Boston & Maine Railroad Company has just been issued, showing gross earnings from June 30, 1904, to June 30, 1905, of $36,213,245. The operating expenses amount to 73.5 per cent. The total increase in earnings during the year amounts to $1,329,342. After paying all expenses, $136,285 is added to the sinking fund. 2,286 miles of road are now operated by the company. Thirty-eight locomotives have been added to the equipment during the year. The total number of locomotives in service is 1,025.

It is estimated that orders now on the books of the locomotive, steel rail and car manufacturers amount to $250,000,000. Personal inquiry addressed to leading railroad equipment concerns indicates that this is a conservative estimate. All of the railroads expect heavy increases in business, and they are preparing to take care of it by renewing and extending their equipments.

The Genesee River Railroad, recently incorporated by officers of the Erie Railroad, will be 34 miles in length, extending from Hunts, near Portage, in Livingstone county, New York, to Cuba, on the main line of the Erie Railway.

New Works of the B. F. Sturtevant Co., at Hyde Park, Mass.

The accompanying illustrations will give some idea of the extensive new works of the B. F. Sturtevant Heating & Ventilating Company, at Hdye Park, Mass. The rise and progress of the company has been something phenomenal. A destructive fire four years ago was a serious blow to the company, which, however, seemed only to stimulate the energies of the promoters. The popularity of their work and the rapid increase of business rendered a new site necessary, and an admirable location was found about 6 miles from the old quarters. The lot selected has a frontage of 1,300 ft. upon the freight yard of the N. Y., N. H. & H. R. R. at Reedville Station. One side of the lot is bounded by a beautiful stream, which adds much to the natural beauty of the vicinity.



INTERIOR OF MACHINE SHOP.

The floor space is more than double that of the old works. The area of the new finished buildings is over nine acres. There are now about 1,300 skilled workmen employed, although over 2,000 will be necessary when in full working order. The buildings are admirably arranged with a view to extension in length when necessary. Spurs of the railroad run between each section of the buildings. The type of construction is somewhat composite in its character, consisting of steel interior columns and main steel girders, with extra heavy brick walls, wood timbered floors and plank roofs. In the one-story foundry the roof is supported by steel trusses. The main floors in the machine, fan and erecting shops are of concrete, upon which 3 in. hemlock is bedded in liquid pitch. All roofs are of 3 in. plank with tar and gravel top.

The entire plant is electrically driven and lighted from a central power house. The exhaust steam from the engines is utilized for heating, supplementary live steam being admitted as required. Steam, electricity and compressed air are conveyed to the different buildings in a concrete tunnel and an additional system of covered trenches.

The foundry, 170 ft. by 350 ft., is designed for the distribution of molten iron upon a floor track system, and is equipped with a railway of 24 in. gauge set in concrete, which form runways between the moulding floors. The machine shop is 500 ft. in length, with wings 40 ft. wide, furnished with cranes of 20 tons capacity, the total width of the shop being 120 ft.. The lighting, which is very effective, is secured by saw-tooth skylights running crosswise of the roof and facing due north. The upper floors of this building, which is three stories high, is devoted to the electrical department, and is also provided with smaller cranes. The store room, measuring 40 ft. by 100 ft., occupies a corner of the machine shop and is the common repository for all parts of the machines between the time of their completion and their requisition for assembling. Every known machine can be found in the machine shop, all of the newest and best designs. The upper floors take the form of galleries and are spanned by bridges, allowing light and ventilation in every part of the great machine shop.

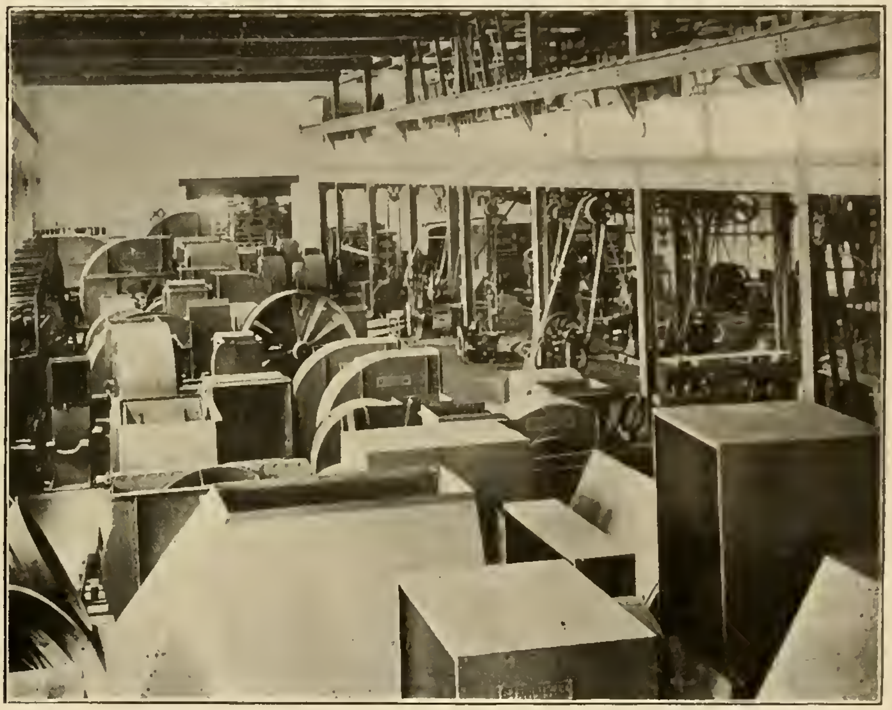
The fan shop is 32 ft. from floor to roof, to allow for the construction of the great blast fans for mechanical draft. Here also are built the heater jackets, some of them as large as a two-story house. Adjoining are shears and folding plates for cutting and bending sheets 10 ft. in length. The adjoining storage shed has capacity for nearly a thousand tons.

Immediately adjoining is the extensive shipping department, and an important section for the Sturtevant steam hot blast apparatus. Here are millions of feet of one inch pipe to be cut and threaded ready for the cast iron bases and tested at 180 lbs. per square inch. In the upper floors are the galvanized iron sections, the construction of smaller fans, the manufacture of exhaust heads, and the baking room for armatures. On a lower floor is the extensive testing apparatus used in conducting the rigid tests demanded by the U. S. Navy Department for the apparatus which is furnished from time to time.

The smith shop is equipped with a full outfit of Sturtevant forges with exhaust fans. The painting of the entire shops is in a rich green to the height of five feet; the rest of the entire building is white. All of the buildings are heated and ventilated by the Sturtevant system. All of the shops are models of structural beauty and comfort. The adjoining offices are commodious and elegant.

Oakland and Sacramento, Cal., are competing for the proposed new shops of the Western Pacific, which is to unite the Pacific Ocean at Oakland with the Atlantic at Baltimore. It will be the first transcontinental line under one management.

About a third of the entire population of the world speaks the Chinese language or its allied dialects.



ERECTING FLOOR FOR FANS AND HEATER JACKETS.

Exhibits at Traveling Engineers' Convention.

An important feature of this year's convention was the large number of exhibits furnished by the railway supply men. The display in every case was very artistically arranged and the representatives vied with each other in explaining the utility of their wares to the interested visitors.

Among the most prominent exhibitors were:

Crandall Packing Company, of Palmyra, N. Y., was represented by Mr. F. M. Vosburgh. They had a very complete exhibit of the different kinds of packing which they manufacture. Samples were distributed to those interested.

Joseph Dixon Crucible Co., of Jersey City, N. J., were very much in evidence with samples of their polishing graphite for locomotive front ends, also their graphite air brake and triple valve grease. The pencils which they distributed were very much appreciated by the members taking down notes of the convention.

The Garlock Packing Co., of Palmyra, N. Y., was represented by Mr. E. C. Adams and Mr. F. A. Ebert. They had an extensive exhibit of mechanical rubber goods, metal and fibrous packings, hose, etc. Their catalogue is very complete and well worth the asking for. The souvenir knife which they distributed is one of the best we have seen. Mr. Adams' sleight of hand performances were truly wonderful, and he was consequently very much in demand for entertainment purposes.

Jenkins Bros., of New York, also had

a complete line of packing. They claim their "96" packing cannot be beat, that it will not rot, burn, blow or squeeze out, or require to be followed up, and is possessed of great durability.

Michigan Lubricator Co., of Detroit, Mich., represented by W. E. Bryant, had on exhibition "The" Bull's Eye lubricator, samples of two, three, four and five feed lubricators, also air compressor lubricator and air brake lubricator.

The Pyle National Electric Headlight Co., of Chicago, was very ably represented by Mr. Mark Ross. The handsome and very useful pocketbooks which he distributed were very much appreciated and they will be lasting and pleasant reminders.

S. F. Bowser & Co., of Fort Wayne, Ind., had on exhibition an oil tank which should hold a place in every rounhouse and shop in the country. It would prove a "money saver."

Mr. Chas. P. Storrs, manager of Storrs Mica Co., of Owego, N. Y., while he did not have an exhibit was very much in evidence, and made himself very valuable by his willingness to assist in every form of entertainment provided for the members and guests.

The Crane Co., of Chicago, represented by F. D. Fenn, was in attendance, and distributed a souvenir metal "Elephant," manufactured by themselves. It was in commemoration of their fiftieth anniversary, and was intended to denote "Character," "Intelligence" and "Strength," to all of which high attributes the company is justly entitled. The elephant itself is a very pretty ornament.

Detroit Seamless Steel Tubes Co., of Detroit, represented by Messrs. Halliday and Owens, exhibited sample pieces of seamless steel tubing which had been subjected to the most rigid tests. There is no question that these tubes have obtained a secure foothold with railroad companies. Their plant is being kept busy day and night.

The International Correspondence School, of Scranton, was very much in evidence by the number of its representatives that were present. Messrs. Mitchell, Sawyer, Conger and several others looked after the company's interests. The fountain pen which they distributed was an excellent and useful souvenir.

The excursion provided jointly by the Detroit Seamless Steel Tubes Co. and the Detroit Lubricator Co. was one of the pleasantest features of the convention. The members and guests embarked on the steamboat "Sappho" with a band of six pieces in attendance, sailed through the Detroit river at a slow rate of speed, thus giving all ample opportunity to admire the beautiful scenery on either side, to the St. Clair lake. There were about 400 persons on board, and their comfort was most assiduously looked after by the representatives of both companies. There was provided an abundance of refreshments and dancing was indulged in by those who desired, and these were largely in the majority. Altogether it was a most delightful trip, occupying about five hours, and the companies originating this excursion deserve the highest amount of credit for the liberality in which it was carried out.

In every case where souvenirs were given away, those members who were unable to be present can obtain same by making application to those alluded to by mentioning Railway and Locomotive Engineering.

Norton Ball-Bearing Jacks.

The aptitude to fail at the critical moment has been the weak point in hydraulic and other jacks. The Norton jacks, manufactured by A. O. Norton, Boston, Mass., have the element of reliability in a marked degree, and as a consequence have become very popular among railroad men. There are now over 40,000 in use, and they are made in every size, for every possible purpose, and will work in any position.

The White & Middleton Gas Engines are continuing to gain in popular favor, and Mr. R. H. Thomas, machinist and engineer, 107 Liberty street, New York, has just issued an elaborate catalogue giving a complete history of the evolution of the engine from a comparatively crude engine to the perfect engine of to-day. The work is beautifully illustrated.

Crane & Co., Chicago, issued a new circular last month illustrating their new flanged pipe joints. The methods of construction are fully explained, the joints being made by welding a wrought steel flange to the pipe by special machinery. This entirely precludes the possibility of a leak between the pipe and flange. The illustrations are in the best style of the art, and the letterpress description leaves nothing to be desired.

The Pennsylvania Railroad ordered 17,000 new freight cars last month. They will be 100,000 lbs. capacity and cost about $17,000,000. This year will be the greatest in the history of the company as far as railroad equipment is concerned.

Seven young aristocratic Chileans are at the Baldwin Locomotive Works finishing in a practical way their course in the mechanical engineering school of Santiago, Chile. They are to be very industrious and attentive.

Special Fifty-Car Train Demonstrations at West Seneca, N. Y.

Not since the now famous Burlington air brake trials, with the possible exception of the exhibition made at East Pittsburgh last May to the delegates of the International Railway Congress, has a long train air brake demonstration been made before railway officials as that made on August 23 on the New York Central tracks at West Seneca, N. Y., before the large number of railway officials gathered together to witness these unusual demonstrations.

Private cars containing officials were run from all directions to Buffalo, bringing together a most notable gathering to witness the tests to be made by the Westinghouse Air Brake Co.'s special train, equipped with quick service triple valves, friction draft gear and automatic air and steam couplers, and slack adjusters.

The train consisted of 50 steel underframe, wooden sides, gondola cars, whose light weight each was 45,000 pounds, and a dynamometer car. This train was also equipped with old style standard triples, so arranged that either the quick service brake or the standard brake could be quickly cut out and the other made operative.

The train was handled by a P. R. R. Consolidation engine, weighing 173,000 pounds, and carrying 205 pounds steam pressure. The cylinders were 22x28 ins. and the diameter of driving wheels 56 ins., giving a tractive force of 40,000 pounds. The tests were as follows:

Test No. 1. Standard (old style) triple valves. Speed 21½ miles per hour. Reduction 20 pounds. Stop was made in 557 ft. 9 ins. (Compare with test No. 2.)

Test No. 1A. Repeated with 5 pounds reduction. Speed 22¼ miles per hour. Stop made in 1,612 ft. 10 ins.

Test No. 2. Quick-service (improved) triple valve. Speed 22¼ miles per hour. (Same as Test No. 1.) Reduction 5 pounds. Stop was made in 456 ft. 2 ins. (Compare with Test 1A, then with No. 1.)

The purpose of Tests Nos. 1 and 2 was to show that practically the same length of stop is obtained with 5 pounds reduction for new triples as with a 20-pound reduction with old triples, thereby making it possible to operate positively a train with a much larger number of brakes in operation, when equipped with new valves, than can be done successfully with old style valves, which fact has been demonstrated with 100-car train test, the air working throughout with new style valves.

Test No. 3. Quick-service (improved) triples. Speed 22 miles per hour (same as Test No. 1). Reduction 17 pounds (equalization). Stop was made in 382 ft. It should be noted that equalization with the new triples requires only 17 pounds reduction, while old triples require 20 pounds. Test No. 3, when compared with No. 1, will show lengths of stop obtainable by the two different types of triples when the brake cylinder and auxiliary pressures are equalized.

Test No. 4. Standard (old style) triples. Speed 22¼ miles per hour. Reduction, 10 pounds. Stop was made in 774 ft. 6 ins.

Test No. 5. Triples arranged, twenty-five standard (old style), twenty-five quick-service (improved), alternating in groups of five. Speed 22¾ miles per hour. Reduction 10 pounds. Stop was made in 538 ft.

Tests Nos. 4 and 5 will show (1) that both triples work in harmony; (2) that shorter stops are obtained practically in the proportion to the number of new triple valves introduced.

Test No. 6. Twenty-five standard (old style) triples ahead, and twenty-five quick-service (improved) triples behind. Speed 21¾ miles per hour. Reduction 20 pounds. Stop was made in 469 ft. 5 ins. This test probably represents worst possible combination of old and new triples, proving that the jerk due to the latter being in the rear is not excessive. The stress on the draw-bar at the dynamometer car shows a steady exertion, and an entire absence of "hammer-blow" effect.

Test No. 7. Standard (old style) triples. Speed 31 miles per hour. Reduction 20 pounds. Brakes released at 12½ miles per hour and full head of steam at once applied to keep train in motion. A coupler knuckle broke on the rear end of the nineteenth car, under a steadily increasing test of 170,000 pounds, more than four times greater than the tractive effort of the engine.

Test No. 8. Quick-service (improved) triples. Speed 30 miles per hour. Reduction 5 pounds. Brakes released at 15 miles per hour, as in Test No. 7.

The purpose of tests Nos. 7 and 8 is to show that releasing at slow speed, which causes so many "break-in-twos" with a standard apparatus, is practically rendered harmless with the improved type of triple valves, for the reason that the new triples release brakes on the rear end first.

Test No. 9. Standard (old style) triples. Speed 32 miles per hour. Reduction 10 pounds. Brakes released at 15½ miles per hour, and full head of steam applied to keep train in motion. Train speed was finally reduced as low as 6 miles per hour, before all brakes were off, but no "break-in-two" ensued, although the dynamometer car showed a steady draw-bar pull of 42,000 pounds, which speaks eloquently of the virtues of the friction draft gear, and its ability to absorb shock and jerk.

Test No. 10. Test No. 9 repeated with

quick-service (improved) triples. Speed 33 miles per hour. Brakes released while at a speed of 16 miles per hour. Speed dropped to 4 miles per hour before all brakes were released, although engine was tugging violently all the while on the train. There was no "break-in-two" nor severe "hammer-blow" shocks.

Test No. 11. (Friction draft gear tests.) Train backing at speed of 8 miles per hour, engine reversed and full head of steam applied.

This test was designed to represent usual yard conditions. A jerk of 95,000 lbs. was recorded on the draw-bar of the dynamometer car, but the train did not break in two, the draft gear smoothing down the shock to a gradually increasing and sustained jerk of 95,000 lbs. The "hammer blow" effect was entirely missing.

Test No. 12. (Friction draft gear test.) With slack bunched and reverse lever in back motion, lever suddenly thrown ahead and full head of steam applied.

Results similar to those in Test No. 11, and absence of "hammer blow" shock, merely a gradual accumulating and sustained tension of 98,000 lbs. occurring.

Test No. 13. (Friction draft gear test.) With ten rear brakes fully applied and slack bunched, reverse lever thrown ahead and full open throttle used. An absence of "hammer blow" shock. A uniformly increasing and sustained tension of 118,000 lbs. Train did not break in two.

This test was intended to demonstrate the ability of the friction draft gear to absorb heavy shocks and strains.

Test No. 14. (Friction draft gear test.) At speed of 15 miles per hour, emergency application made from the rear car, engine working under full head of steam throughout the test.

A uniformly increasing and sustained tension of 87,000 lbs. resulted on the dynamometer car draw-bar, no "hammer blow" shock. Train did not break in two. This test was intended to represent conditions existing when a hose bursts on rear of train.

Test No. 15. (Friction draft gear test.) Train separated at tenth and fifteenth cars, forward section backed into second, and without stopping, into rear portion, at speed of 4¼ miles per hour. This test was made to show ability of the friction draft gear to absorb shock and prevent broken draw-bars, and coupler knuckles.

Test (a) 4¼ m.p.h., 170,000 lbs. buffing stress. Test (b) 8 m.p.h., 430,000 lbs. buffing stress. No broken knuckles or draw-bars. An appealing demonstration of the valve of friction draft gear.

Test No. 16. Duplicating Test No. 15 at speed of 8 miles per hour. Buffing stress of 420,000 lbs. No broken parts. An extraordinary achievement of the friction draft gear.

Test No. 17. Duplicating Test No. 15 at speed of from 8 miles per hour. Result practically the same as in Test No. 16.

Test No. 18. (Automatic air coupler test.) With all cars from tenth to twentieth uncoupled, test made to determine time necessary to couple up both couplers and hose connections, release brakes and move train. One brakeman employed during this trial. This test was intended to illustrate the saving in time to be obtained by the use of automatic air hose couplers.

Fifty-two seconds were required to couple up all cars. In pulling out, one knuckle, which had failed to couple, allowed train to part. Train was again coupled, brakes released and train moved in one minute and fifty-two seconds. Had not the knuckle opened, the whole time record would have been reduced to fifty-two seconds.

By special request of several officials present, some low speed emergency tests were also made, it being believed the shocks, due to brake application at very low speeds, would be disastrous and beyond the ability of the new brakes and friction draft gear to withstand. The tests and results are as follows:

Special Test No. 1. Speed 33¾ miles per hour; emergency application; stop, 506 ft.

Special Test No. 2. Speed 6½ miles per hour; emergency application; stop, 14 ft.

Special Test No. 3. Speed 10 miles per hour; emergency application; stop, 49 ft.

In this test the 25 head brakes were cut in and 25 rear brakes cut out. No broken couplings, knuckles or other parts.

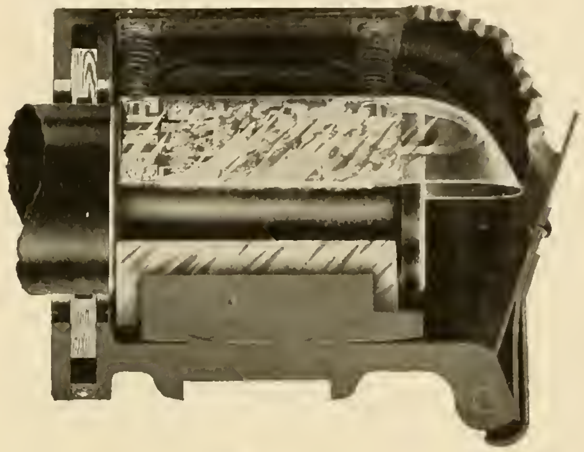
The Cincinnati Milling Machine Company have made several important improvements in their milling machines recently, and have just issued a finely illustrated catalogue of 112 pages describing their millers, dividing heads, indexing attachments, spiral heads, undercutting attachments, slotting attachments and rack and circular milling attachments. In addition to these, vises, shell arbors, universal cutters and tool grinders form special features of the publication which ought to be in the hands of all who are interested in the finest kind of fine machine tools, especially adapted for the quick handling of light work.

The desire to rise in the world in some form or other is the mainspring of human activity. It encourages industry, inspires enthusiasm, develops power, kindles energy.

Improved Car Journal Lubricator.

The Harrison Lubricator, as shown in the annexed illustrations, is an excellent device, ensuring perfect lubrication, with a large saving of waste and oil. The lubricator is pressed out of one piece of cold-drawn, open-hearth sheet steel, resiliently mounted upon a malleable base, the springs ensuring a constant contact with the axle without the possibility of the oil overflowing.

As will be seen from the outer appearance of the box, the marked improvement in the inner construction has not in any way changed any of the truck connections. The boxes are made to conform to the Master Car Builders' standard boxes and journals. From the reports that have been made by those who have adopted the lubricator it saves its cost more quickly than any other improved appliance in connection with the operating of cars. They are being manufactured by the Harrison-Williams Company, of Toledo, O.



IMPROVED TRUCK BOX.

CELLAR FOR IMPROVED TRUCK BOX

Bathing a Tramp.

"The locomotives on many of the fast trains in the East now take water without stopping," remarked Carlton C. Crane, passenger agent of the New York Central Lines. "A scoop is lowered, and the speed of the train forces the water from the trough between the rails into the tank on the tender. In the back of the tank is an overflow vent, and if the scoop is kept down too long the surplus water flows out through the vent and deluges the platform of the express car, immediately behind the tender. This gave rise to a funny incident on the New York Central the last time I was East. A tramp was stealing a ride on the blind platform of the express car. The fireman discovered him and tried to dislodge him by throwing coal at him. But the tramp declined to be disturbed. He was enjoying his ride immensely and smoking his pipe with great satisfaction. The firemen's opportunity came when the train reached the next water trough. He left the scoop down for nearly two miles, and the tramp was subjected to a deluge of water for the greater part of that distance. At the next stop a weary, dejected and washed-out individual, dripping wet and half full of water, climbed down from the blind platform.

"'Say, pard,' he said to the fireman, 'I wish you would tell me the name of that river we ran through about ten miles back.'"

The Fort Wayne Electric Works Company, manufacturers of the "Wood" system of induction motors, have issued a series of handsome Bulletins illustrating the rapid development which has taken place within the last few years in the use of alternating current machinery in nearly all lines of power transformation. The flexibility, economy and safety of such a system for general factory or machine shop operation has brought their alternating current transmission systems into general favor. The latest improvement is the multiphase induction motor, the principles of which are fully explained in their new Bulletins.

The annual report of the Atchison, Topeka & Santa Fe Railroad Company shows total earnings for the year ending June 30 of $68,375,837. The net gain is $204,627. There was an increase of operating expenses of $3,295,351 owing to the floods, but for which the showing of the road would have been the best in its history. The freight revenue increased notably, the passenger traffic being about stationary.

The Road to Fortune.

Shakespeare says, "There is a tide in the affairs of men, which, if taken at the flood, leads on to fortune, that omitted, their whole lives are spent in shallows and in miseries." The tide that comes in the affairs of the young railroad man is when his mind is fresh and impressionable and he does not "groan and sweat beneath the load of a weary life," but comes to his work "caroling like the lark at morn." At this joyous time of life if he would seriously pause for a moment and bethink himself that the number of the things that he knows is infinitely smaller than the number of the things that he does not know, and in relation to that another fact is that on the sum total of his knowledge, coupled with integrity of character, will depend his success in the high calling he has chosen. If he would get a grasp of the root of things in his occupation as far as human ingenuity can instruct him in the construction, running, repairing, testing and manipulating the multitudinous attachments of the locomotive, and a thorough knowledge of railroad mechanical appliances generally, he has only to read RAILWAY AND LOCOMOTIVE ENGINEERING and procure a copy of "Twentieth Century Locomotives" and devote a reasonable portion of his time to the perusal of its pages and he will soon take his proper place among the masters in railroading. The facts garnered in the rich fields of experience and gathered into one golden sheaf will be his—his to carry lightly as the dew on the tender herb, beautifying and refreshing it.

When he speaks he will speak words of wisdom. Men will listen to him and marvel that one so young should be so discerning, he will be pointed to as the coming man. Promotion will come to him, and thus by acting wisely when the tide of affairs brings these opportunities that lie at his hand, his career will "lead on to fortune."

There are other works which he will find helpful, all contributing to his mental make-up, all giving the reflex of a vast and varied experience in the path that he must travel towards being an accomplished master mechanic or superintendent of railroad transportation. The prices of all of these works are very low, the illustrations alone being worth the money paid for them. RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock, delivered monthly to any address, $2.00 a year. It is a welcome visitor in every household.

"Twentieth Century Locomotives," Angus Sinclair Co., deals comprehensively with the design, construction, repairing and operating of locomotives and railway machinery. First principles are explained. Steam and motive power is dealt with; workshop operations described, valve motion, care and management of locomotive boilers, operating locomotives, road repairs to engines, blows, pounds in simple and compound engines; how to calculate power, train resistance, resistances on grades, etc. Shop tool explained. Shop receipts, definitions of technical terms, tables, etc. Descriptions and dimensions of the various types of standard locomotives. The book is well and clearly illustrated and is thoroughly up to date in all particulars, fully indexed. Just off the press. Price, $3.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.co.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. The price of it is 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. The price is 75 cents.

The 1904 Air Brake Catechism. Conger. Convenient size, 202 pages, well illustrated. Up to date information concerning the whole air brake problem, in question and answer form. Instructs on the operation of the Westinghouse and the New York Air Brakes, and has a list of examination questions for enginemen and trainmen. Bound only in cloth. Price, $1.00.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion, it is easily understood by every intelligent fireman. The price is 50 cents.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable, and, best of all, they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Standard Train Rules." This is the code of train rules prepared by the American Railway Association for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotive, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

We are selling Carnegie's book on James Watt. The price is $1.60. Send for it. Excellent value for the money.

Railway Statistics.

The system of "ton-mile" railway statistics, which carries with it the recommendation of American general railway practice, appears hardly likely to make much headway at present with the railways in this country, to judge from the views of leading railway officials which have been appearing in the *Railway News*, and now republished in a separate form by that journal. An impression seems to have been created that in the essentials of advanced practice American railroads are much ahead of our own. While it may be freely admitted that some of the conditions peculiar to the country give the railways a natural advantage over our own, there are other points of equal, and perhaps of superior, weight in which British lines must be conceded to have the advantage. With regard to the relative merits of railway bookkeeping, all of the chief railway lines, with one notable exception, declare that the "ton-mile" system is not adapted to the peculiar circumstances of the British railways. The prevailing opinion on the matter appears to be fairly represented in the views of Sir Charles Scotter, who alleges that "statistics of a much more useful and practical nature than 'ton-miles' are kept by all well-organized railways." Sir Charles instanced as an example of the "useful and practical" statistics in reference, the practice on the London & South-Western Line, where "the loading per truck is watched and recorded day by day, cases of light loading having to be specially explained to the responsible officers of the company." Sir Charles Scotter expressed his conviction that advocates of "ton-mile" statistics could not produce a single case of saving in working as the result of such statistics which could not have been attained "by the more simple and effective and prompt means already adopted by nearly all the railway companies in this country."—*London Times*.

The Santa Fe & Rock Island Railroad have just placed in service four new locomotives of the balanced compound Atlantic type, which is gradually coming into favor as the best passenger engine yet designed. The new engines are running between Rock Island and Chicago.

The Directors of the Erie Railroad have purchased a majority of the stock of the Cincinnati, Hamilton & Dayton Railroad. The latter road controls the Pere Marquette and Chicago, Cincinnati & Louisville, and with them has a mileage of 4,000 miles, passing through the richest section of the Ohio Valley

Locomotives for Cuba.

The Norwegian steamship Otto Sverdrup cleared from Philadelphia on September 13 for Havana and Matanzas with fourteen locomotives and tenders and steel rails. This is the largest shipment ever made from Philadelphia to Cuba. The locomotives and tenders are from the Baldwin shops.

The Reading is double-tracking its branch from Harrisburg to Shippensburg, where it connects with the Baltimore & Ohio. Both roads experienced much inconvenience because of car shortage, and better preparations are being made for the coal traffic this season.

The Northern Pacific Railroad will enlarge the shops at South Tacoma, the chief object being to construct freight cars at the rate of 150 a month. The directors of the company are of opinion that wooden cars can be built cheaper on the West coast than in the East.

Of the 525 locomotives ordered by the Pennsylvania Railroad from the Baldwin Works this year 400 have been delivered. It is expected that the entire number will be in service by the middle of November. With the 200 in course of construction at the company's shops at Altoona, it is decided that additional orders will not be necessary for some time.

Six representatives of the imperial railway system of Japan are in America at present studying the American locomotive and arranging to purchase railway supplies. Toki Oyatz, one of the party, says that Japan is preparing to expend over $30,000,000 in railway material.

In addition to recent purchases of railway material by Japan and Corea, an additional $30,000,000 will be expended for supplies of all kinds, chiefly for the railways in Corea and Manchuria. About two-thirds of the work will be supplied by American manufacturers.

Cheerfulness is the best promoter of health. Repinings and murmurings of the heart give imperceptible strokes to those delicate fibers of which the vital parts are composed, and wear out the machine. In short, the man who worries wastes his energies on self-created misery.

Superintendent McManus, of the Southern Railway, has a novel device to keep track of the locomotives. It consists of a blackboard divided into sections filled with knobs covered with figures and colored disks and triangles; the white indicates an engine in first-class condition; blue, needs from $50 to $100 worth of repairing; orange, requires from $200 to $500; red, $750 to $1,000, while green needs a general overhauling.

The Purdue University, of Lafayette, Ind., has made many changes in the instructional staff of the engineering departments. The faculty now embraces many eminent engineers of wide experience and national reputation.

The Brookfield division of the C., B. & Q. Railroad are installing a hot water system for washing out boilers at Brookfield. It is expected to greatly facilitate the operation. The 74 engines on the division are being worked to the full measure of their capacity, and an increase of equipment is expected at an early date.

The theatrical season has again opened with every appearance of increasing patronage. In New York City, Mr. F. F. Proctor is, beyond doubt, the most successful caterer to popular amusement. He has raised vaudeville entertainment to the dignity of a high art.

The J. G. Brill Company, of Philadelphia, has received a large order for foreign shipments from Brazil. The order includes several hundred passenger cars, to be used on the east coast of the Province of Bahia. They were ordered by the Rio de Janeiro Power Company.

An automatic stoker is being experimented with on one of the Pennsylvania Railroad Company's engines west of Pittsburgh. The apparatus will be given a thorough test and if satisfactory a number of locomotives will be equipped with it.

Twenty-five gasoline moters have been ordered by the Lake Shore to aid in their local traffic on the Dunkirk, Allegheny Valley and Pittsburg lines. Tests have been sufficiently satisfactory to warrant a preference over the electrically-driven car.

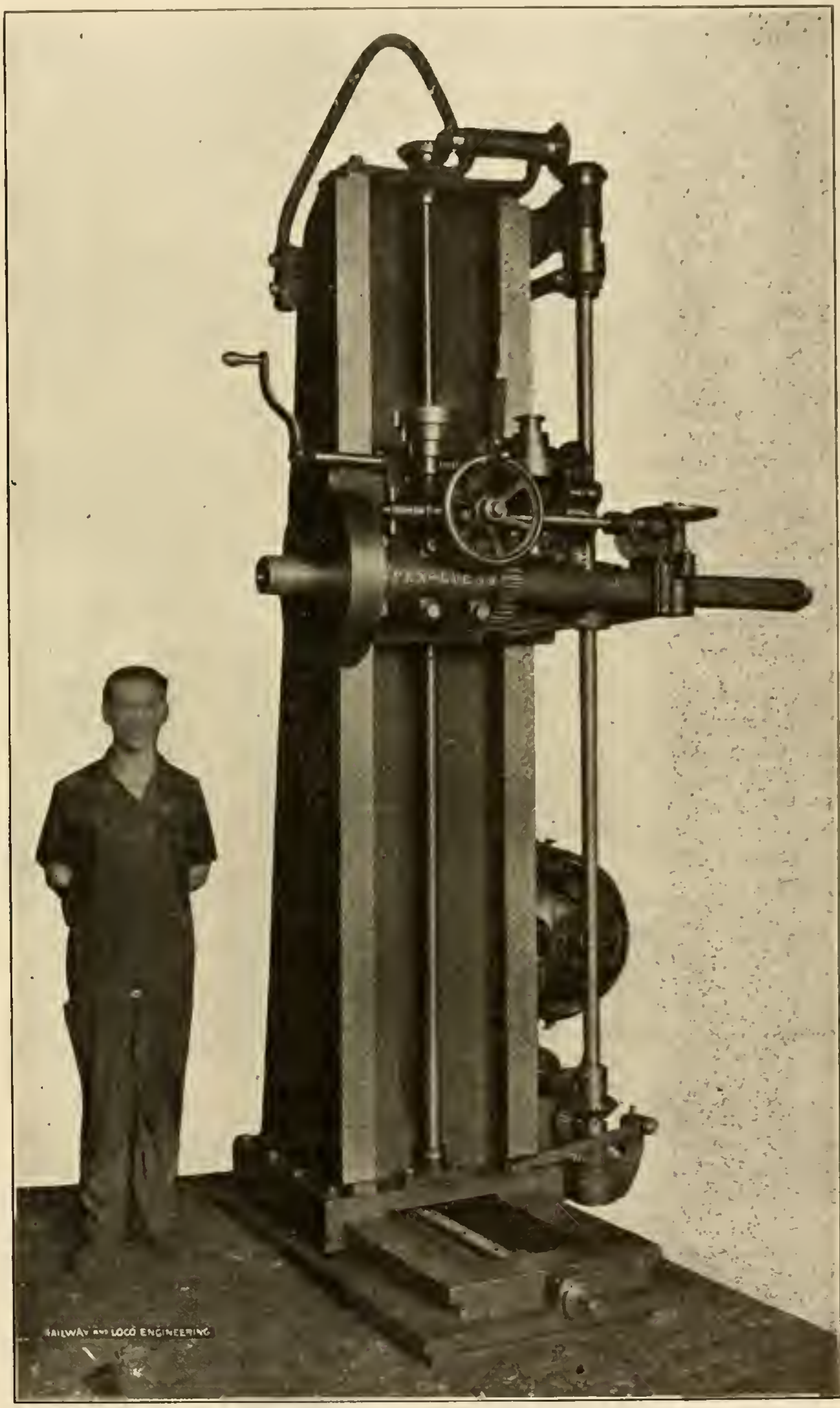
Japan is pushing the construction of railways in Corea rapidly. On one line of 300 miles—the Seoul-Wiju—they have 30,000 men at work. Japan's recent orders for locomotives from the American Locomotive Company number over 150, while from various firms 550 freight cars have been ordered.

He who is never dissatisfied with himself or others, and never discontented with things around him, cannot be expected to make any strenuous efforts at improvement. He may live out a life of ease and serenity, but it will be the case of torpor and the serenity of indolence.

Improved Portable Boring, Milling and Drilling Machine.

The Espen-Lucas Machine Company, of Philadelphia, has just placed on the market several improved portable machine tools suitable for large manufacturing plants, one shown in the accompanying illustration, a 72-in. boring, milling and drilling machine is a very substantial tool, built to carry an 18-in. high speed steel inserted cutter head.

Its range of speeds embraces every requisite from the smallest drill to the largest cutter. The materials are all of the very best, the spindle being of hammered crucible steel 4 ins. in diameter and feeds through a gun metal sleeve, having 24 ins. of feed. The head has a vertical adjustment of 6 ft., and can be set in any position for milling and clamped securely with a feed traversing 24 ins. The spindle has feed in



THE ESPEN-LUCAS BORING, MILLING AND DRILLING MACHINE.

either direction for boring and counter-boring and is very powerfully geared for heavy work. The machine is electrically driven by a 3 to 1 variable speed Crocker-Wheeler motor. The gearings are of the best steel with bronze bearings, and the machine is altogether among the very best that has been produced by the Espen-Lucas Company.

It has been decided that a heavier class of locomotives, with new passenger coaches, dining cars and chair cars, will be used on the Toronto, Hamilton and Buffalo Railroad. Improvements of the roadway are being made, and the service generally will be greatly bettered.

Trygye Negaard, a Norwegian engineer, is at Schenectady inspecting the plants of the American Locomotive Company. He was sent there by the Norwegian Government. Mr. Negaard says the railway system will be greatly extended in Norway.

The Clyde Engineering Company, of New South Wales, Australia, has been awarded a contract to build 60 locomotives for the Colonial Government. The price agreed on is £322,631. Six years is allowed to complete the work.

The new shops of the Buffalo & Allegheny Valley at Olean, N. Y., have just been completed, and the new machinery is being rapidly put in place. The shops are very complete in the matter of modern appointments, having all electrical devices, and cost over $500,000.

The Great Northern Railway Company is completing the equipment of eight new trains which will be known as the Oriental Limited and will run between St. Paul and Seattle. The porters and waiters will be Japanese.

The Great Northern will replace its passenger equipment. Eight complete trains, exactly alike, are ordered. They will run between St. Paul and Seattle.

The Lackawanna Steel Company, of Buffalo, has just secured an order from the Victorian State Railways of Australia for 6,500 tons of steel rails. Another order recently obtained was for 15,000 tons of rails for Havana, Cuba.

The man who wastes mental energy on angry strife is less than wise. If you are tempted to be angry, pause a moment and still the rising activities. Deal in the same way with the tendency to be annoyed, resentful, or depressed. Remember that if you spare yourself these useless expenditures of force you husband your energies best.

The Union Pacific Railroad Company has been experimenting with a new gasoline motor car at Omaha with the most gratifying results. Mr. W. R. McKeen is the builder. Four others are ordered, to run on the local branches in the vicinity of Omaha.

The St. Louis Railway Club resumed its regular meetings on September 8. An able paper on "Ventilation and Hygiene of Railway Cars" was read by Dr. J. M. Gassaway, of the United States Marine Hospital Service. A large number of the members were present.

Fifteen ten-wheel passenger engines and ten compound mogul locomotives for freight service have recently been added to the Grand Trunk Railway of Canada. They were built at Montreal and Kingston.

The St. Paul & Chicago express has been equipped with observation cars with ample accommodation for twenty persons in each car. The unusual size of the observation compartments will permit all to enjoy the idyllic scenery of the Northern Mississippi.

The Brooks Locomotive Works have just delivered ten new passenger engines of the largest Marshall type to the Lake Shore Railway. This increases the ability of the road to make high speed with any train. The weight of engine and tender is about 392,000 lbs.

President Murray, of the Baltimore & Ohio Railway, announces that extensive improvements will be made at Riverside, South Baltimore, at a cost of $500,000. Two large roundhouses, two turntables and pits, a machine shop and oil house, and also a power house will be built. The work will be proceeded with immediately.

The Southern Pacific Railroad Company are now pumping oil from beneath the Pacific Ocean, and the traveler can now see the frame pyramids marking well sites, stretching from the Mississippi clear into the Pacific ocean. The locomotives are being changed to oil-burners as rapidly as possible.

The aggregate purchases of machine tools among the railroad companies is reaching unparalleled proportions, and there is every prospect of this state of things continuing for some time. There is, as might be expected, a slight increase of prices. The improvement in the construction of the machinery is particularly marked, while the tendency is strongly towards heavier locomotives and heavier cars.

To Prevent Strikes.

Nobody ever hears of a strike at the Baldwin plant. Yet it is probably the largest manufacturing concern in the world except Krupp's, at Essen, Germany. The Baldwin works employ no less than 17,000 people, which, adding the men's families, represents a city of 50,000 inhabitants. The firm have been in business for years and years and they turn out eight complete locomotives every day. But whatever business conditions may be, the Baldwin men never strike.

The reason is this: All the thousands of foremen at the works are independent, sub-contractors, and all the work is "piecework." Any man that shows the ability to take charge of making any small fraction of a locomotive can hope to get a contract for furnishing a certain number of those parts. He then hires his own men, pays his own wages and makes his own condition for his men. Each contractor runs his own business. Consequently no more than half a dozen to a score of men are really employed by the same boss. Having so few employees under him, he can and does take a personal interest in their work and their welfare. If a workman is dissatisfied, he has only to change his boss, but he can usually adjust all difficulties without going to that extreme. If the man goes to a new boss, he doesn't necessarily leave the Baldwin works. He can change dozens of times and still remain at the same old plant. No combination is permitted among the bosses, but each is compelled to carry on an independent business.—St. Paul, Minn., *Dispatch*.

East River Tunnels.

The two tunnels of the New York & Long Island Railroad under the East river, between New York and Long Island City, brings the total number of subaqueous tunnels entering Manhattan Island up to fourteen. The new railroad will connect with the present New York subway system at Third avenue and 42d street, at which point a large subterranean station will be built about 80 feet below the subway grade. Escalators will carry passengers from Long Island to the subway station and the surface. At the eastern terminus, connection will be made with surface lines on Long Island.

The Ingersoll-Sergeant Drill Company, of New York, have received orders for fourteen air-compressors, of two different types. Eight are of duplex compound type, with cylinders 16 ins. by 28 ins., the others are of straight line, with 24 in. steam cylinders. The aggregate air capacity of the fourteen compressors is 18,304 cubic feet per minute.

The shield method will be used in driving these tunnels. The straight line compressors will furnish air to the headings for keeping out the water, and will also supply intake air to the other machines.

This last order makes a total of 54 Ingersoll-Sergeant air compressors in use or contracted for on subaqueous tunnels entering New York City. The aggregate free air capacity of these machines is 138,426 cubic feet per minute, and the pressures delivered range 30 to 150 lbs. This company has furnished all the compressors for this class of work in New York and vicinity.

Important Publication.

A digest of United States Patents of Air, Caloric, Gas and Oil engines from 1789 to July, 1905, compiled by James T. Allen, Examiner U. S. Patent Office, will be published in Washington. The work will be the only one ever published comprising this class, and the material is being prepared with great care and labor. The drawings will be perfect photographs of the original drawings with letter press descriptions embracing over four thousand separate patents, subdivided into 205 classes arranged to simplify and facilitate examinations. The work will be issued in three volumes containing nearly 2,000 pages, and is expected to be ready this month.

Inventors, manufacturers, and attorneys will see the great advantage a work of this kind affords, enabling any one to make examinations as quickly and thoroughly as if consulting the official records. The work also ought to be among the indispensable reference works at all of our public libraries.

The Cleveland Pneumatic Tool Company has issued a sixty-four page, finely illustrated catalogue showing the latest designs and improvements in their chipping and riveting hammers, drills, hose couplings and other pneumatic appliances. The catalogue is particularly valuable as showing a detailed view of the parts, giving a full description of the methods of operating to the best advantage. The riveting hammers, which are rapidly coming into popular favor, appear in a large number of sizes adapted for every conceivable kind of work. The catalogue should be in the hands of all who are interested in boilermaking, structural or general work where drilling or riveting is required.

Mr. J. N. Duntley, president of the Chicago Pneumatic Tool Co., returned last month from Europe. While abroad the extensive works at Fraserburgh, Scotland, were started up, and give every indication of meeting with marked success. Enough orders are already in hand to keep the works in full operation for many months. Another factory was started in Berlin, Prussia, and arrangements are perfected for erecting a factory in Russia. Compressor equipments and pneumatic tools are being rapidly introduced in Europe, and Mr. Duntley states that the foreign business during the next few years will rival that of America. Meanwhile the orders for compressor plants and tools come pouring in from all over America. One hundred and fifty-seven Franklin compressors have been installed during the last three months. Many of the leading railway companies are giving large orders which will keep the company busy for a long time to come.

The Jerome Metallic Packing Company have issued a fine new catalogue illustrating their latest designs in piston and valve rod packing. Twenty-five years' experience has given the company opportunities to perfect their specialties, which are now acknowledged by railroad men to be the best of their kind. The repair rings are a new and admirable feature of their work. Ready to be applied without disconnecting pistons or valve rods, they can be said to fill a long-felt want. Finely finished oil cups and adjustable swab holders are given to their customers gratis.

The Niles-Bement-Pond Company, 111 Broadway, New York, have just issued a large, finely illustrated catalogue showing their latest designs in electric traveling hoists and trolleys. The economy of handling heavy material by electric traveling cranes has been very clearly demonstrated. The present catalogue deals particularly with the line of electric traveling trolleys and hoists for moving loads weighing between one-half and five tons. These may be adjusted to run on a single I-beam, making it possible to install them in places where it would be impracticable to arrange for crane runways. The company furnishes special catalogues of their larger traveling cranes.

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

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Schenectady.

The railroad man who has not heard of Schenectady is a poor creature. It is a long time since locomotives built by Septimus Norris at Schenectady began to penetrate into the remotest wilderness and sound the praise of their origin. Then came the McQueens, from the same place that attained great fame for many years, and even beyond the life of their maker, for after Albert J. Pitkin had improved the engine in design and workmanship, many railroad men persisted in calling Schenectady locomotives "McQueens."

There is considerable diversity in the pronunciation of the word "Schenectady" and it lends itself to a great variety of sounds. One time that Mr. Pitkin visited the famous Krupp works, in Germany, and was waiting to be escorted about, one of the officials entered the waiting-room with the card in his hand and exclaimed, "Mr. Pitkin, I shall gladly show you about the works if you will tell me how to pronounce the name of that town you come from."

Schenectady is rapidly forging forward as a great manufacturing town, thanks to the start it received from locomotive building. A correspondent of the New York *Sun* lately gave this brief history of the town:

The electric touch of industrial progress has stimulated the venerable town of Schenectady in a manner which must relegate to retirement the popular song "It's Eighteen Miles from Schenectady to Troy."

Schenectady (Schagh-nack-taa-da, *i. e.*, beyond the hills) was established in 1684 on the site of an Indian village on the Mohawk, Oran gugh haroe ("a great multitude collected together"). It was the meeting place of the Mohawks. Holland Dutchmen first settled it. It became a city in 1798. Three years before that Union College, which has added much to the celebrity of Schenectady, was established. From 1798 to 1898 Schenectady was a small central

CUMBERLAND NOTCH IN MARYLAND, SHOWING NATIONAL HIGHWAY AND TWO LINES OF RAILROADS.

New York town made notable by song writers, parodists and humorists on account of its name.

In 1890 it had a population of only 19,000—not much for a New York city established a century before. But electric appliances came to be manufactured in Schenectady and locomotive engines made there. It became "the electric city," with a force of 3,000 workers in electrical appliances. The population grew in ten years from 19,000 to 31,000. The growth begun in 1890 did not culminate in 1900 with 31,000. The present population of Schenectady, five years later, is 58,369, and at the recent rate of increase Schenectady in 1910 will be a city of 100,000, one of the chief cities of the Empire State.

The enormous influences of electricity upon the development of the industrial interests of the United States is shown in this growth.

Extensive Additions to the Long Island Railroad Shops.

The great boom in building operations in New York City seems to have infected the railway companies in the vicinity. The Long Island Railroad shops at Richmond Hill, a beautiful suburb of New York City, although of comparatively recent construction, are being added to, in order to meet the rapidly growing demand for larger facilities for the construction and repair of their ever-increasing stock. The car shops are being increased by two additional sections, measuring 250 ft. in length by 115 ft. in width, making fifteen tracks with accommodation for two cars each. About 150 ft. has been added to the large machine shop, now measuring 400 ft. by 120 ft. The electrically driven cars now in full operation to Rockaway Beach have necessitated these important additions, besides a complete renewal of machinery, especially in the car department.

It may be remarked that the introduction of the electric service to Rockaway has proved of much greater difficulty than was expected. The 200-h.p. motors, of which there are two on each car, have been found of sufficient strength to pull four or five cars of the largest kind, with the heaviest possible traffic; but the tendency to heat in the bearings and working parts of the motors generally has been exceptionally great. As much as 50 per cent. of the motors have been laid off for repairs at one time, necessitating a large increase of the working force and considerably affecting the regularity of the service. Much of the difficulties have been overcome, and the results of each week show an improvement in the service, but it is evident that the friction incident to motors of such power requires larger bearings than is possible in ordinary car-trucks, and that it would be advisable to introduce a much larger number of motors of less power, so that the enormous friction could be distributed over a wider field. Electric engineers might also find a substitute for the spur-wheels now in universal use in car motors. The vibration incident to such mechanism is very great, while the rapid wear of the parts is something phenomenal.

The mammoth power-house at Long Island City, 8 miles distant, furnishes the power for all the new machinery in the shops. When the alterations and additions are completed each machine will be driven by a separate variable-speed motor, except a few of the smaller machines, which will be run in groups. In the blacksmith shop the electric suction blasts are already in operation, and the smoke is conspicuous by its absence. The entire buildings, which cover an area of over twelve acres, are of brick, with ornamental granite facings; the roofs, trusses and supports being of structural steel. The flooring is of solid concrete work, faced with asphalt, and the new additions harmonize with the works built twelve years ago. Further extensions are already spoken of, and it seemed to us that a much further extension of the machine shop would have been advisable at the present time. There are a large number of the newest and best machines in the machine shop, but the intervening spaces are altogether too limited for the free handling of engine work.

There are about 900 men in the works, the great bulk of whom traverse the eight miles of distance night and morning between Richmond Hill and New York, the company furnishing free transportation at all hours to their employees.

A growing peculiarity of railroad-shop accessories meeting us at every step is the use of expanded metal. In the floors and roofs, in the construction of store and toolrooms, in casings and railings, it meets us everywhere, strong as a wall of brass and transparent as day. It is a great and growing feature of twentieth century building construction.

We cannot close these brief notes without referring to Mr. Thomas Fildes, the assistant superintendent of motive power, who pointed out the new additions and improvements in the works. He is a Western man who has learned the details of his high calling in many places and under varying conditions. He spoke freely of the marvelous forces of electricity, but it was easy to see that the steam engine was his first and true love. There were eighteen locomotives in the engine shop undergoing repairs, and he knew every bolt in them by heart. A freight engine passed the end of the shop. There was a slight variation in the volume of the beat of the exhaust. It was scarcely noticeable, but Mr. Fildes commented on it. He stated in his easy western way that it was the work of some "smart Aleck" who thought he was doing a clever thing by setting the valves exactly square and not making any allowance for the space occupied by the piston-rod. His ear was tuned to the melodious murmur of the Twentieth Century Locomotive.

Peter Cooper's Locomotive.

Peter Cooper's locomotive which began running from Baltimore to Ellicott's Mills on August 28, 1830, was not the first locomotive seen in America, but it was the first to accomplish anything. The year before, on May 17, 1829, the sailing vessel John Jay reached these shores with the English-built locomotive aboard that had been purchased for the Honesdale road, the tramway constructed by the Delaware & Hudson Canal Company for their coal mines at Carbondale, Pa., to Honesdale, the head of the canal. This English locomotive was called the "Stourbridge Lion."

The situation on the Baltimore & Ohio was one wholly different than that at Honesdale. The Maryland enterprise was strictly a railway for general utilization. Incidentally, of course, Baltimore was to profit by becoming the terminus of the railway. This is where Peter Cooper came in. He was then, as he was to the day of his death, a New Yorker. He had large landed interests in Baltimore, and his comprehension was broad enough to realize that the entire vicinity would profit through the consummation of the undertaking.

Peter Cooper wasn't a man of mechanical attainment; had no especial aptitude in such direction, and certainly no experience. Nevertheless, not only was he the inspirer of the first locomotive built to accomplish the first practical movement by steam on rails in America, but the indomitable pusher against obstacles until he downed every one of them and became the father of steam-operated roads on the continent.

Peter Cooper went to the length of designing a locomotive and having what he called such built. This was in 1829, just about the time the "Stourbridge Lion" was delivered in New York. The engine Cooper sent around from New York to Baltimore by sailing vessel. The railroad people had no faith in it, nor had any one else to speak of, save Cooper.

The company didn't want anything more to do with it, so Cooper, having fallen in with two bright young Baltimore mechanics—George W. Johnson and James Milholland—sent the "Tom Thumb," as he christened it, to them with a carte blanche to remedy every defect and insure the next trial trip.

Cooper's tiny "Tom Thumb," with the car attached, on that 28th of August, seventy-five years ago, made the run without a break from Baltimore to Ellicott's Mills in an hour and a quarter and the return trip in fifty-seven minutes. One horse was its computed power,. and the weight in entirety it drew was four and one-half tons, the average speed being twelve miles an hour.

From the Baltimore & Ohio, with its twenty-five miles of road in operation in 1830, has come two hundred thousand miles of railway; and descended from Cooper's little engine, the cost of which was probably within a thousand dollars, are to-day fifty thousand locomotives, representing five hundred millions of money; while succeeding that first car others have come into being to such number and of such cost as to carry the seventy-five years' record for that going to insure modern train completeness to the billion mark.

4-6-0 Engine for the D., L. & W.

The Schenectady shops of the American Locomotive Works have recently turned out some passenger engines for the Delaware, Lackawanna & Western Railway, which in several respects may be described as machines of more than ordinary interest. They are simple engines designed to burn fine anthracite coal. They have cylinders 22½x26 ins., and driving wheels 69 ins. diameter.

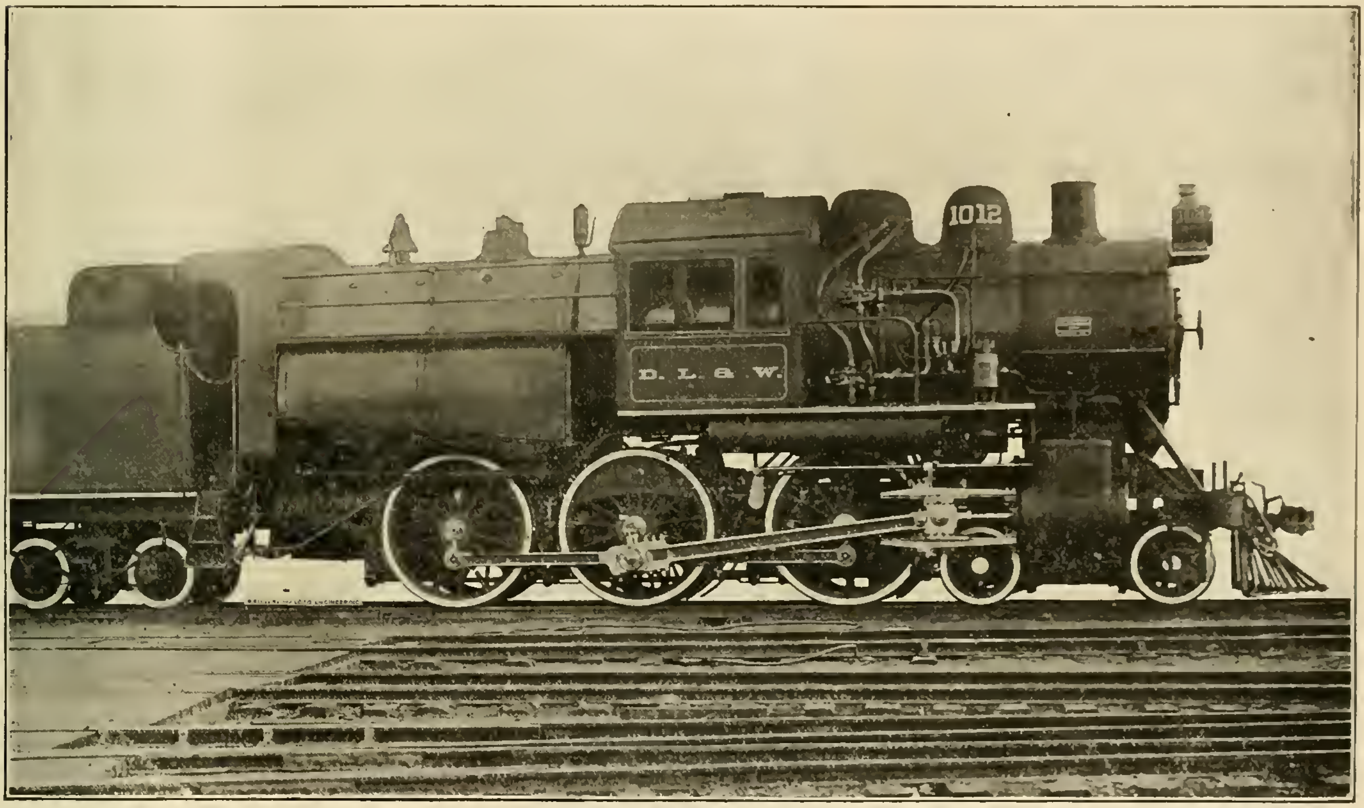
The engines are very powerful, having a tractive effort of 35,000 lbs., with weight on drivers of 154,000 lbs. These figures give a ratio of tractive power to adhesive weight of 4.4, showing that the weight on the drivers is fully utilized. The total weight of the engine itself in working order is 201,000 lbs., which is small for the power which can be developed.

The valve gear is indirect and the valves themselves are of the Allen Richardson type. The links have a radius of 53 ins., and a long valve rod is employed which passes outside the forward driving wheel. The guides are two in number with upper one made in what may be called a T-section, the crosshead being lipped up on each side so as to run flush with the outer edge of the guide. This arrangement gives the same amount of wearing surface and at the same time eliminates the chance of collecting dirt and grit where the crosshead edges are beyond the sides of the guides. All the wheels on this engine are flanged and the springs of the main and leading driver are overhung. The engine truck is of the 4-wheel pedestal type with wrought iron frame.

The boiler has a straight top and is 74⅝ ins. diameter at the smoke box end. The fire box is of the Wooten design and is 126⅛ ins. long by 108¼ ins. wide, with 4 in. water space all around. The grate area is, therefore, 94.8 sq. ft. The size of the fire box necessitates the centrally placed cab. The staying is, of course, radial, with ⅜ in. thickness of crown sheet; ⅝ in. for tube sheet, and ⅜ in. back and side. The driving wheels, 69 ins. in diameter, are large when the design of the fire box is considered, but the details have been carefully worked out, and, although the boiler is not unusually high, there is ample space between back driver and fire box.

The tubes are 398 in number and are 2 ins. in diameter and are made out of No. 12 B. W. G. charcoal iron. The length of each tube is 15 ft. 3 ins., which gives a heating surface of 3,156.3 sq. ft. The fire box gives 221.7 sq. ft., thus making a total of 3.378 sq. ft. The arrangement of injectors and pipes on this engine is well shown in our illustration, both injectors are on the right side and the steam pipes come directly from the outside of the dome, and water is delivered to the boiler through a pair of top checks which are enclosed in one casting, placed on the center line of the boiler. The pressure carried is 215 lbs.

This D., L. & W. engine is about 2,000 lbs. heavier than some very similar locomotives which the American Locomotive



4-6-0 FOR THE DELAWARE, LACKAWANNA & WESTERN.

R. F. Kilpatrick, Supt. Motive Power. American Locomotive Co., Builders.

Company recently built for the Lehigh Valley, and though other engines of about the same dimensions have been built, with greater tractive effort, notably some 22x28 in. Pacific type engines for the Southern Railway, the total weight of the D., L. & W. design is small for its pulling capacity. The engine is neatly proportioned and presents a pleasing appearance. A few of the principal dimensions are here appended for reference.

Wheel Base—Driving, 14 ft. 4 ins.; total, 25 ft. 6 ins.; total, engine and tender, 54 ft. ¼ in.
Weight, in working order, engine and tender, 321,000 lbs.
Axles—Driving journals, main, 10x13 ins.; others, 9½x13 ins.; engine truck journals, diameter, 6½ ins.; length, 12 ins.; tender truck journals, diameter, 5 ins.; length, 9 ins.
Tender Frame—10-inch channels and plates.
Tank—U-shape, with hood at front; capacity, 6,000 gallons; capacity fuel, 10 tons.
Valves—Travel, 5½ ins.; steam lap, 1 in.
Setting—1/16 in. lead in full gear; ford and shift back-up eccentrics to give ¼ lead at 6-in. cutoff; ford motion.

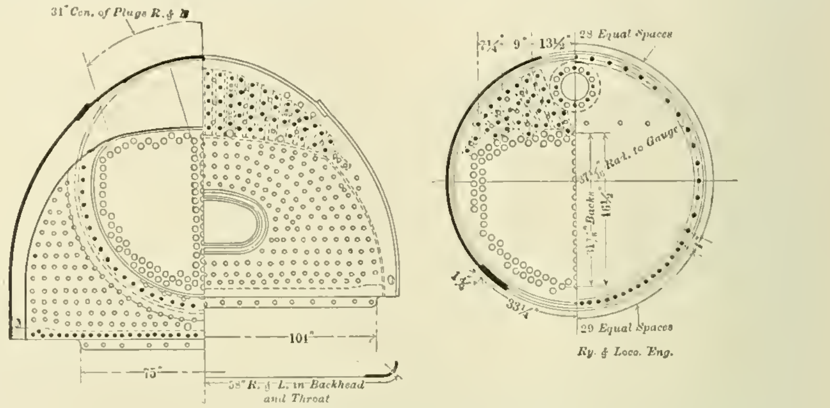
Acts of Providence.

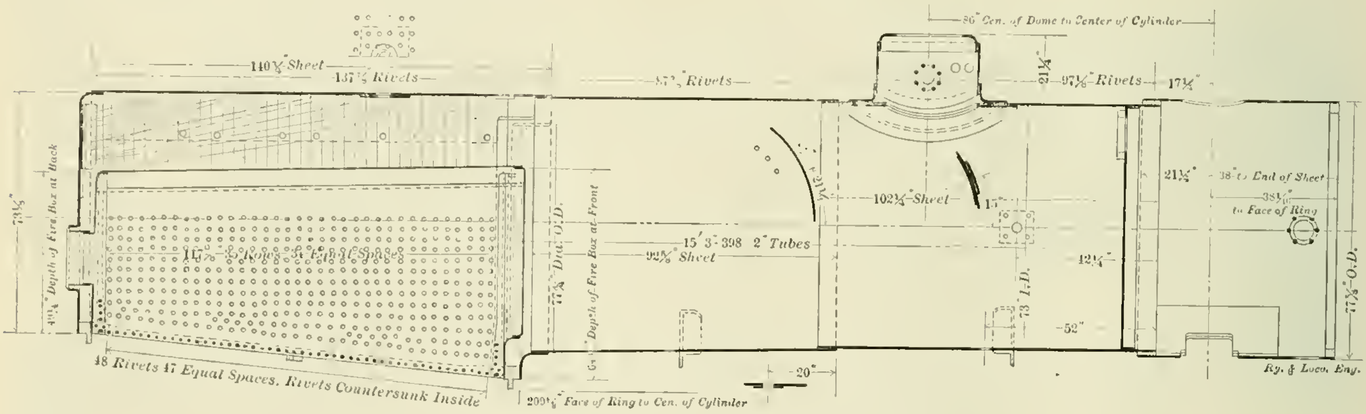
A striking discussion took place in the Master Car Builders' Convention on acts of Providence connected with the destruction of cars by storm and flood. The conclusion reached was, Providence or no Providence, railroad companies on whose lines cars might be destroyed are responsible for the cars being replaced or their value returned to the owners. It was a wise decision, and will work fairly all round in the interests of justice.

In British transportation circles the expression, "an act of God," is very often employed to excuse delay or failure to deliver articles that transportation companies have undertaken to carry. A storm or a wreck was usually called "an act of God," which was beyond the control of the carrier. An amusing illustration of a passenger trying to plead the same case happened in an English court a short time ago. A traveler in an open railway car proceeded to show his ticket to the conductor, when a gust of wind blew it out of his hand, and he refused to pay fare a second time, maintaining that the action of the wind in blowing the ticket out of his hand was "an act of God." When summoned before a magistrate on the complaint of the railroad company, he set up the same defence, but the magistrate did not take to it kindly, and not only punished the man for refusing to pay his fare, but for blasphemy in the defence set up.

Such a high authority as President Hill, of the Great Northern, denounces as lies the assertions of politicians that railroad freight rates have not been reduced in 25 years. In a speech at Portland, Ore., Mr. Hill stated that the reduction in the average rate per ton per mile in 25 years on the Great Northern Railway aggregates $667,000,000. That has been the reduction that the people have got on one railroad. I am not afraid that any Federal regulation will ever get down deep enough to touch us where we live, because, long before they do, the country will be strewn with railroad corpses. They would bankrupt two-thirds of the mileage in the United States.

The tendency of modern designing of powerful freight locomotives errs in readiness to add wheels that are not used for increasing the adhesion. The application of carrying wheels often produces a slippery engine. A tractive increaser is a mistake resorted to in an effort to remedy a mistake. They have removed the traction increasers that were several years ago applied to the Atlantic type engines of the various railroads.





BOILER OF LACKAWANNA'S EXPRESS TEN WHEELER.

Railway from Damascus to Mecca.

In June of this year we were able to show a picture of a curious viaduct on the railway between Damascus and Mecca, which line is called the Hedshas Railroad. Our illustration admirably showed the kind of country through which this road runs. The intention is to have branches to the Mediterranean and the Red Sea and the enterprise has been set on foot primarily for the purpose of carrying pilgrims to and from the holy cities. In consequence of the facilities which will be afforded to pilgrims a great deal of the money necessary to build the road has been subscribed by the faithful and there have also been contributions of stone and timber to be used in the work.

About a year ago the main line south from Damascus, a distance of 285 miles, was opened for traffic. This year an extension on the branch eastward across Palestine has been opened. This branch is in all about 100 miles long and is graded up from 850 ft. below sea level to a height of 1,210 ft. above it. It may be of interest to Biblical students to know that the present terminus, the town of Deraa, was once the residence of Og, the king of Bashan.

Electric Drive in Locomotive Repair Shops.

BY A. S. ATKINSON.

The gradual extension of the electric drive in locomotive shops for more economical and efficient results indicates that the experimental stage has been largely passed, and the question uppermost in the minds of engineers and operators is the more complete equipment of the shops with machines that will show definite results. In the daily operation of a repair shop the full capacity of the engines and motors is rarely approximated, and usually half of the possible maximum total of power is the average consumed, and the ratio of the load-factor to the maximum power must be considered in estimating cost of work. The number of tools that are either standing idle or working under light loads is always sufficiently great to secure for electricity an advantage that in the aggregate amounts to a considerable sum in the course of a year.

VICE REGAL TRAIN ON THE GREAT INDIAN PENINSULAR RAILWAY.

The ability to secure actual data in regard to the amount of power used for driving various individual tools and machines by electricity has proved of inestimable value to the operating engineer. By means of a voltmeter and an ammeter in the motor circuit exact measurements of the power delivered to each motor for driving a tool are obtained, and the question of loss and inefficiency of any part of the equipment is easily solved. The actual economy found in an electrically driven repair shop is thus very striking, owing to the saving of power when part of the tools is idle or running lightly and to the fact that unprofitably operated machines can be quickly singled out and repaired or displaced.

In the large car shops of the Buffalo, Rochester & Pittsburgh Railway Company, at Du Bois, Pa., the electrical drive has now been in use for upward of two years, and the results obtained have demonstrated some of the high efficiency and economy of electric operation. The plant was one of the first in the field of electric equipment, and its completeness is unusually satisfactory. Starting in with an equipment sufficient to handle the repairs of 150 locomotives a year, with a further extension that will shortly bring the total up to 225 locomotives a year, or about 18 locomotives a month, the shops have yielded results up to date that are of special significance.

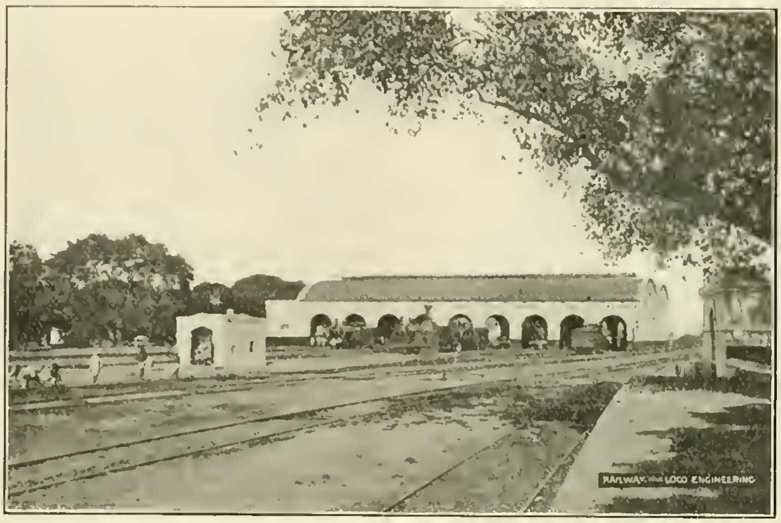
By adopting the central power system, the machine, boiler and tank shops are under one roof, and electricity is distributed from this building to the various units of the plant, including the blacksmith shop, roundhouse, office and storehouse, and oilhouse. The extension of the works is made comparatively easy by the simple addition of new buildings, for the power capacity has been designed for increasing the demands of the plant in the future. The central station or power-house furnishes all the electricity and compressed air for driving all the machinery, lighting the different houses, operating fans and blowers, and other mechanical work. The wires for transmission of electricity are carried in underground conduits to the different buildings, and there is no obstacle to restrict free operations in the yards between the buildings.

The power-house is equipped with four 200-horse power water-tube boilers. The furnaces are of the latest pattern, but are hand fired and designed for economical consumption of coal in the generation of steam. Steam is supplied from the boilers to simple and compound engines, direct-connected to electric generators. The largest of these is a 200-horse power compound engine, direct-connected to a 125-kilowatt direct-current, compound-wound generator. This generator carries the day load for operating the machine tools, cranes and other mechanism of the shops. It operates at 250 volts and makes 280 revolutions per minute. In addition to operating the machinery, it is used for supplying light for such parts of the shops which need it in the daytime. The lighting load, however, is very small on this generator, for a separate 100-horse power engine has been installed for lighting the yards, car shops and freight and passenger station. This lighting engine is connected by belts to a 60-kilowatt generator, operating at 200 volts and making 900 revolutions a minute.

SUBURBAN TRAIN, USED FOR SERVICE ABOUT THE CITY OF BOMBAY, GREAT INDIAN PENINSULAR RAILWAY.

The night load of the machine and car shops is much lower than the day load, and a 100-horse power simple engine is used for this purpose. This engine is connected by belt to a compound-wound generator operated at 250 volts and making 750 revolutions per minute. Like the first generator, this is a direct-current machine, while the one employed for lighting purposes operates on an alternating current.

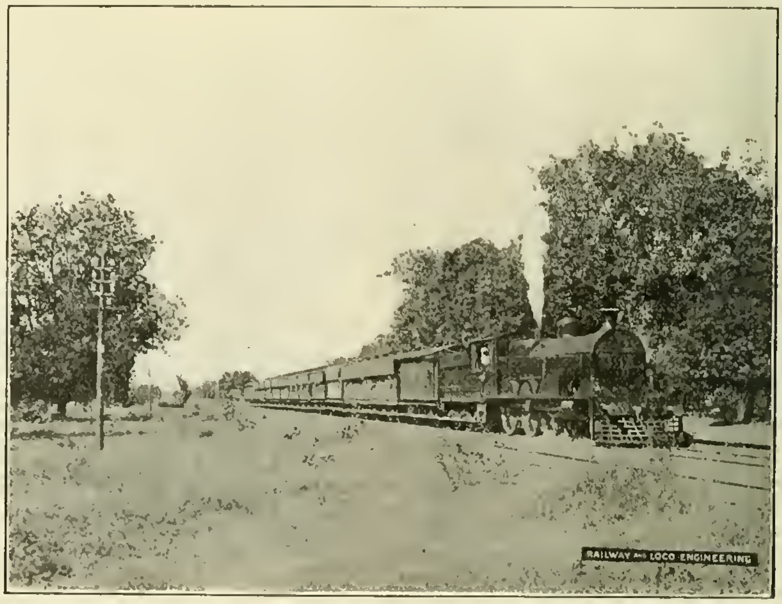
There are two 50-ton electric cranes traveling on an overhead track down the locomotive-erecting shop. These cranes are equipped for handling economically any weight that may be lifted for repair work. On either side of the aisle down which the cranes pass are located shed bays equipped with shafting for driving the machine tools. The five lines of shafting are driven by five shunt motors. The tools and machines operated by the shafting can be run singly or in groups. While in full operation machines can be connected or disconnected without loss of time or power. It is this facility of change of load from light to heavy and back again without loss of time or power that makes shop operation efficient and economical.



LOCOMOTIVE RUNNING SHED, EAST INDIAN RAILWAY.

In the wheel section of the repair shops the line shafting is 200 feet long, and is composed of cold-rolled steel carried on roller bearings. The shafting is so evenly and nicely balanced that, despite its weight and size, it can be turned by hand. There is consequently little loss of power through turning the shaft and belts, although the friction of the latter adds a slight load. The diameter of the shaft is 2½ ins. There are 26 hangers on the 200-ft. shaft. In a series of practical tests extending through many months of work it was found that an average of 1.5 horse power is necessary for the operation of the line shaft and counters, but this was the maximum starting load and was not maintained in continuous work.

Connected with this shaft are a number of large machines, including a 42-in. car-wheel boring mill, a 48-in. car-wheel lathe, two 79-in. wheel lathes, 60-in. planer, 84-in. boring drill, 6-ft. radial drill, 18-in. slotter, and a number of tool grinders and quartering machines. In the operations of the shop in the past year practical tests have shown that the power consumed by single machines has been relatively small, while the operation of groups of the machines have shown a further economy. In all of the tests it was found that the power consumed at the starting of a machine was nearly always four to six times as much as required for continuous operation.



BOMBAY-CALCUTTA MAIL TRAIN, BENGAL-NAGPUR RAILWAY.

A group of machines started at once might thus consume the maximum of power for a few seconds, but the load would almost immediately fall.

Thus one of the 42-in. wheel lathes, with one tool cutting, requires 0.5 horse power for steady operation, but when first connected the consumption of power for starting reached a maximum of nearly 5 horse power. The 62-in. planers cutting cast-iron cylinders, require the greatest power at reversal, and this often reaches as high as 8.5 horse power, although in the ordinary running only 2 horse power are consumed. The same is true of the slotters. An 18-in. slotter that is operated at 0.5 horse power requires 1.2 horse power at reversal.

Similar practical tests have shown that a band saw running light or cutting 4-in. oak requires 4 horse power, but upon starting the maximum is often 6.3 horse power. Other tools used in the wheel section of the repair shop consume various amounts of horse power under full loads. A 79-in. wheel, with two tools making roughing cuts on a pair of drivers, has been continuously operated at an average consumption of 4 horse power, and an 84-in. boring mill, boring an 8-in. cylinder, operated under 2 horse power in continuous work, and an emery wheel used upon only 0.7 horse power.

The steady operation of a single tool holds a constant ratio to the running of a group of machines connected to the same shaft, but in some cases a saving is effected by grouping certain tools for continuous work. Thus an 84-in. boring mill, a 79-in. wheel lathe, a 6-ft. radial drill, a 69-in. planer and an 18-in. slotter should consume when running singly approximately 8 horse power, with nearly 16 horse power with the planer and slotter at reversal. But when operated in a group on the same shafting only 6.9 horse power were consumed in steady running, and about 14 horse power at reversal of planer and slotter.

This economy of operation in groups was further shown in the running of machines and tools in other sections of the shop.

In the boiler section, for instance, where the shafting is driven by a 30-horse-power shunt-wound motor, a group of machines operated continuously for fifteen minutes showed a saving over the operation of each machine separately. The line shaft in this section is 170 ft. long and has 19 hangers, and the speed of the shaft is 158 revolutions per minute, operated with the counter-belts off at an expenditure of 0.3 horse power. A single 48-in. punch and shear averages 6.9 horse power at starting when running light, and consumes only 0.4 horse power after it has been running evenly for a short time. With 5/16-in. steel plate put under for shearing, the consumption of power immediately reaches 3 horse power.

Data in regard to the operation of drills in the boiler section when running light and under full load have also been obtained. A 6-ft. radial drill running light used 1.1 horse power, after consuming 3.6 horse power for starting. Only a slight additional amount of power was needed for cutting through steel, the amount varying from 2 to 3 horse power, according to the thickness of the steel. A 6-ft. radial drill cutting steel with 1½-in. drill, and a punch and shear running light, operated together on the shaft, consumed only 2 horse power for steady running, and when a 1-in. staybolt cutter was added to the group, cutting 12 threads per inch in operation, the consumption of power was less than 3 horse power after the start. When first thrown into operation, however, the amount of horse power consumed to start the staybolt cutter was found to approximate 4½ horse power.

In the lathe section of the repair shops a line shaft 180 ft. long and 2½ ins. in diameter, with 22 hangers, is driven by a 30-horse power, shunt-wound motor at a speed of 155 revolutions per minute. With counter-belts the shaft requires 0.7 horse power to operate it. With a single 26-in. planer cutting cast iron the required power for continuous operation averages 3.5 horse power, and a 16-in. shaper cutting 1/32-in. steel at 12-in. stroke consumed at the start 1.4 horse power, but this quickly fell to 0.9 horse power, and even dropped as low as 0.2 horse power for continuous operation. The sharp variation in the load was due to the work of cutting, which was not continuous nor of all the same grade of steel. A 24-in. turret lathe while in operation and cutting steel has been run steadily at as low as 0.3 horse power, and a 24-in. lathe boring brass demanded no more than 0.03 horse power for ordinary work.

Grouping a number of tools and machines in this department, the consumption of horse power was found to be relatively lower than when single machines were used. Thus when a group was connected up consisting of a 26-in. planer, three 16-in. lathes, one 18-in. lathe, one 24-in. lathe, a 16-in. shaper, a 24-in. drill press and a centering machine, the load running light required only 2.4 horse power and a maximum of 7.6 at the reversal of the planer. Thus an economy was obtained in the operation of the machines in a group.

Similar results have been obtained in the operation of two 26-in. planers, one 36-in. planer, each cutting steel with one tool; a turret lathe, an emery wheel, three 16-in. lathes, a 36-in. boring mill, a drill press and a shaper. The operation of this group required a maximum of 15 horse power, but under continuous operation the average consumption was 6.9 horse power.

In the tool section of the shop it has been found that a 28-in. lathe, cutting steel, requires on the average 2.5 horse power for ordinary running and 4.7 horse power for starting up, and some of the large grinders used up 1.95 horse power for steady operation and as much as 9.7 horse power for starting. In the blacksmith shop bolt-headers running light require 0.5 horse power, after starting at 7.8 horse power, and when running under a load, heading 1-in. bolts, the average has been 3.5 horse power. A 25-in. punch and shear that started at 5.5 horse power and ran light at 0.5 horse power required 4.3 horse power shearing 1½-in. round bar. In the flue section a single flue-welder, with blowing fan attached, runs light at 3.4 horse power, but takes 7.1 at starting. The pipe-cutter, cutting 2½-in. pipe, runs at 0.06 horse power.

The 70-ft. turn-table, operated by a 10-horse power direct-current motor, geared to an independent traction wheel, is run when light at 4.45 to 5 horse power, but with a locomotive and tender weighing approximately 286,000 lbs. the power consumed to reach full speed is 7.35 horse power, but after that it is operated steadily at full speed by 5.50 horse power.

The exact data obtained from reading the meters for the different machines enable the engineers to figure out the relative cost of running the various groups and single tools in the shop, and as such they furnish the basis for future improvements in the interests of economy. Furthermore, it has indicated that the grouping of different machines on line shaftings is a matter that may yield much higher results than formerly. The maximum power required to start up some of the heavier machines, and the great consumption of power by the planers at reversal, show that these machines if all grouped on one line shafting might overload the motors to such a degree as to cause trouble if they were started up at once The grouping of some of the smaller machines on the shaft with the larger ones, on the other hand, adds so little to the load that they prove of no importance in the general operation of the motors. Such slight additional loads thrown on the shafts, even when running at the maximum load of the larger machines, scarcely affects the ultimate results at all.

The modern designing of locomotive repair shops is one of the questions of the day which concern railroad companies, and since the electrical-drive has come to stay it is important that data concerning the operation of the tools and machines be obtained to indicate the most economical and efficient grouping of the machinery under one roof. The modern repair shop of a railroad is often the place where the question of profit and loss is decided, and its efficiency must be paramount.

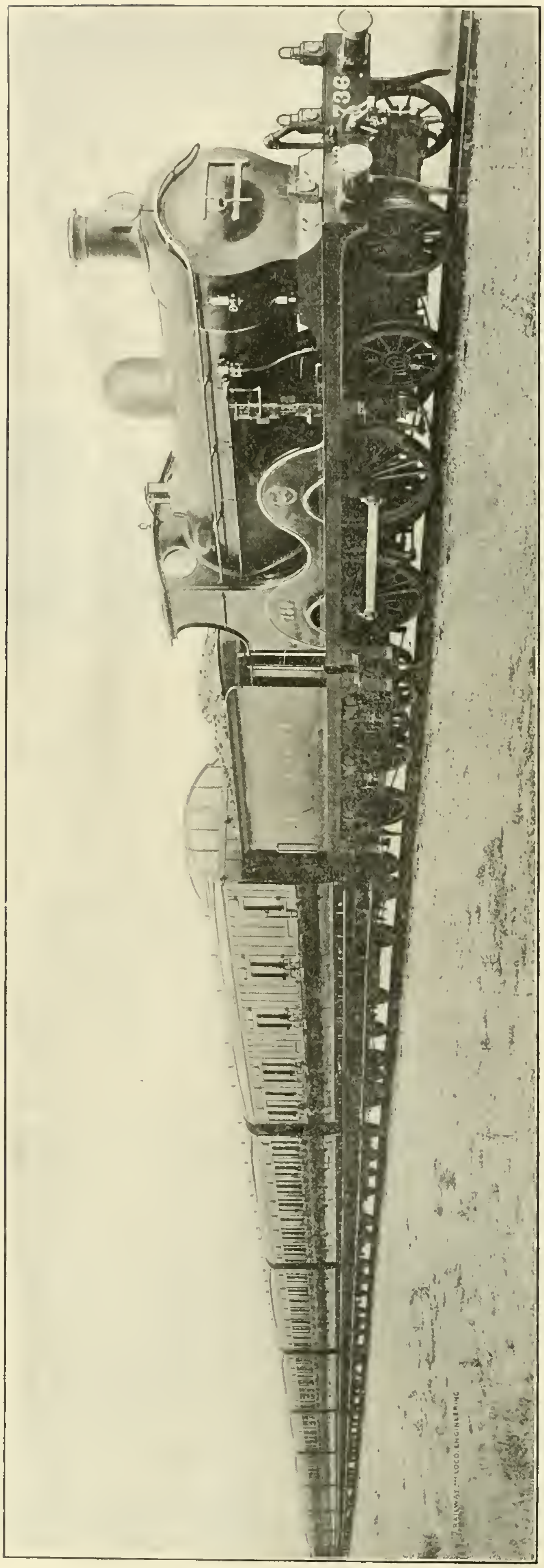
Holding Up a Train.

The holding up of a railway train by robbers is now getting to be a rare occurrence, but the hold-up of the Great Northern last month near Ballard, Wash., shows that railway robbery is not yet a lost art. The train was skilfully flagged, and when the engineer slowed up two masked men presented revolvers while another deftly uncoupled the engine. The engineer was ordered to pull ahead about 200 yards. The express messenger refused to open the baggage car; a charge of dynamite was placed against it, and the explosion blew the car nearly to pieces. Charles Anderson, the express messenger, was severely injured. The safe was blown up, and about $50,000 fell into the hands of the robbers.

A Moving Accident.

An oil-burning locomotive at Houston, Texas, last month had the fuel tank just filled with oil when the feed pipe sprang a leak. The engineer sent his locomotive at full speed for the roundhouse. The oil tank exploded and the inflammable liquid was thrown over the engine, which instantly became a moving mass of fire. The engineer and fireman escaped. The crown sheet of the boiler blew out. The fire department came to the rescue. The engine was badly damaged

The traffic is becoming so heavy on the Rock Island Railroad that the big order of over a hundred new engines which was made in the spring is not sufficient to meet the requirements of the road.



SOUTH-EASTERN & CHATHAM EXPRESS TRAIN.

South-Eastern & Chatham Express Train.

The fine engraving of a British express train here shown was made from a photograph sent us by our agent in London, Mr. A. R. Bell. The train is equal in appearance and equipment to anything seen in Europe. It is known as a corridor train, and is equipped with all modern conveniences.

Concerning the train Mr. Bell writes:

The trains under notice have been built for the company, from the designs of Harry S. Wainwright, locomotive engineer, by the Metropolitan Amalgamated Railway Carriage and Wagon Company, Limited, Birmingham.

The train for the Folkestone route runs in connection with the afternoon boat to Boulogne, and has accommodation for first-, second- and third-class passengers. It consists of the following vehicles:

Two bogie first-class carriages, 51 ft. long.

One bogie composite first- and second-class, '51 ft. long, having a first-class saloon compartment.

Two bogie composites, first- and second-class, 50 ft. long.

Two bogie composites, first,- second- and third-class, 51 ft. long.

Two bogie third-class, with guard and luggage compartment, 50 ft. long.

The total seating accommodation being as follows:

First-class seats	119
Second-class seats	104
Third-class seats	88
Total	311

The train for the Dover-Calais service consists of the following vehicles:

Five bogie first-class carriages, 51 ft. long.

One bogie composite, first- and second-class, 51 ft. long, having a first-class saloon compartment.

One bogie composite, first- and second-class, 50 ft. long; and

Two bogie second-class, with guard and luggage compartment, 50 ft. long.

The total seating accommodation being as follows:

First-class seats	171
Second-class seats	80
Total	251

The carriages are of the uniform width of 8 ft. 0¾ in. over the mouldings, and are generally of the type adopted for all the new rolling stock of the company. The exteriors are painted rich crimson "lake," fine-lined with gold.

The principle adopted throughout the train is that of the "compartment" system, excepting that one carriage in each train has a first-class saloon.

The compartments are spacious and most comfortable in their appointments, and ample lavatory accommodation is provided for all classes.

It is in the internal arrangements that the most noticeable improvements exist. The carriages are all fitted with steam heating apparatus, on Laycock's system, with a storage heater in each compartment and furnished with a heat regulator by which passengers can regulate the temperature in each compartment.

The carriages are brilliantly lighted by J. Stone & Co.'s patent improved system of electric lighting, with double batteries working at 24 volts. The total candle power of the lamps in each first-class compartment is 24 candle, each second-class 20, and each third-class compartment 16 candle.

The third-class compartments are upholstered in plush, and the interior woodwork is of teak and bird's-eye maple.

Every care has been taken in the general design for the comfort of the passengers.

The partitions between the compartments are double-boarded and packed with "felt" in order to deaden noise, and India-rubber pads of special design are largely employed between the body and underframing to absorb vibration

The principal members of the underframe are of steel, and the bogie trucks of steel. The bolster springs are of "Timmis" double-web section, in triplets at each end of the bolsters, and the truck springs, of 5-ft. span, are furnished with India-rubber auxiliary springs at their ends.

The buffer springs are arranged in the center longitudinal framing at each end of underframe, and the connection to the corner buffer-heads is by an equalizing beam pivoted to the central buffer plunger, thus enabling the buffer-heads to keep in contact at both sides and tend to steady the carriages when passing through curves.

The trains are fitted throughout with the automatic vacuum brake, to which the passenger communication apparatus is connected.

The upholstery and cabinet work of the compartments is of high-class finish, and the decoration is in excellent taste. In the first-class compartments the upholstery is covered with "Saladin" tapestry, and the cabinetwork is of walnut; the panels of the ceiling and those above the seats being finished with Lincrusta-Walton in white and relieved with gold, thus producing the fullest amount of reflective surface for the lighting of the compartment.

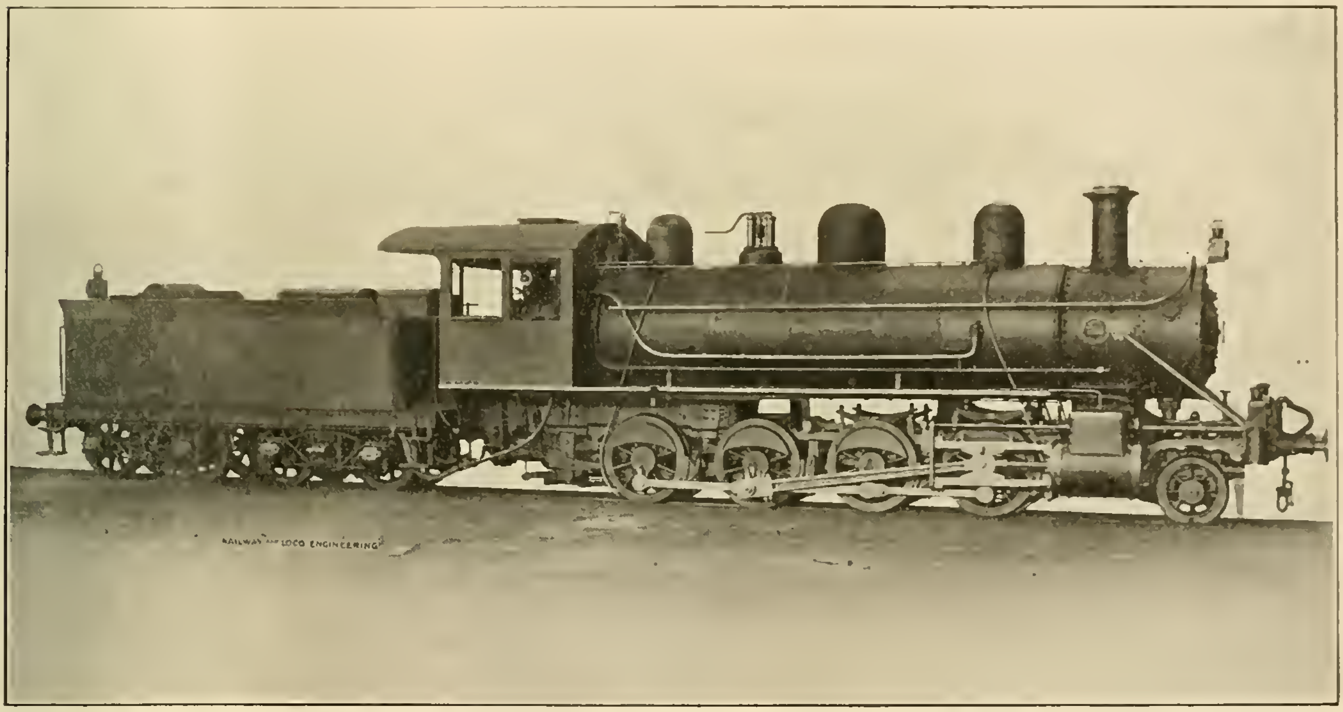
In the second-class compartments the upholstery is of "Tashmere" velvet and the cabinetwork of mahogany.

"Uralite" paneling, which tends to keep the compartments cool in summer and warm in winter, is used for lining the insides of the roofs of both first- and second-class compartments, and on this the Lincrusta decoration is fixed.

The coal production of the United States now exceeds 1,000,000 tons per day, of which the railroads consume about 40 per cent. A locomotive consumes about $5,000 worth of coal per year.

Consolidation Locomotive for the Imperial Government of Japan.

The Baldwin Locomotive Company have recently finished at their works in Philadelphia a number of freight locomotives of the Consolidation 2-8-0 type for the Imperial Government of Japan, and are busily engaged on a further installment of the same class of locomotives. The general design and appearance of these engines are somewhat similar to a number recently built by the Baldwin Company for the Central of Georgia Railway Company, the chief difference being that in the Georgia locomotives the gauge is of the usual regulation width of 4 ft. 8½ ins., while those for the Japanese Government are of the 3 ft. 6 ins. gauge, the width in vogue in that country. The fire box of the Japanese engines is also much longer in proportion to the size of the engine, and overlaps the back driving wheels a considerable distance, adding much to the adhesive force of these comparatively small but powerful engines.



2-8-0 BALDWIN FOR THE IMPERIAL GOVERNMENT OF JAPAN.

As will be seen from the accompanying illustration, the boiler is of the straight-top kind, the diameter at the front end being 58 ins., the thickness of the sheets ⅝ in., adapted to a working pressure of 180 lbs. The staying is of the radial type, the fire box measuring 10 ft. 3 ins. in length by 29 ins. in width, with a depth of 52 ins. The fire box sheets, which are of copper, are ½ in. in thickness. The tubes, which are of Nos. 12 and 14 wire gauge brass, are 215 in number, 1¾ ins. in diameter by 13 ft. in length. The water spaces on the sides and back of the fire box are 3 ins. wide, the space in front being 4 ins. wide. The total heating surface on these engines amounts to 1,386 ft. 9 ins., which is very large and ought to produce steaming qualities of the very best kind.

The cylinders are 18 ins. by 22 ins. The valves are of the balanced type, with valve gearing of the Stephenson link type working through rocker arms. As will be seen from the illustration, the crossheads are coupled to the third driving wheel, the extremely long reach of the main rods lessening the effect of the angular thrust on the guides. The diameter of the driving wheels is 43 ins., with journals measuring 7 ins. by 8 ins. The engine truck wheels are 29½ ins. in diameter, with journal bearings 5⅜ ins. by 7½ ins. The wheel base, rigid, is 14 ft., the total engine wheel base being 21 ft. 4 ins., while the wheel base of engine and tender together measures 48 ft.

The weight of these engines is 104,250 lbs., of which 93,800 lbs. is on the driving wheels, with 10,450 lbs. on the front truck. The total weight of engine and tender is 165,000 lbs. The tender truck wheels have a diameter of 37½ ins., with journals 4½ ins. by 9 ins. The tank capacity is 2,760 gals. of water, with space for 100 cu. ft. of coal, the fire box being adapted for burning soft coal. The space in tank would hold about 4¼ tons of coal. The tractive force of these engines, calculating the effective cylinder pressure at four-fifths of the boiler pressure, is 23,870 lbs., giving a coefficient of adhesion equal to 4.37.

Completion of the Hudson River Tunnel.

The New York & New Jersey Railroad Company's second tunnel from the east shore of New Jersey to the New York water front was completed last month. The two tubes are now cut through the entire length so far as a passageway goes, but it will perhaps be more than a year before the interior structural work is completed and the two tracks laid ready for traffic. The work was begun in 1874, and has been beset with many difficulties. Engineering as well as financial disasters have occasionally overtaken it, but there is every indication that the work will now be rapidly pushed to completion, and an important artery of traffic will be added to the great gateway of American commerce.

The entrance at the Jersey end is at the foot of Fifteenth street, Jersey City. The circular shaped tunnels each measure 15 ft. 4 ins. wide. A small-gauge railways runs through both at present, which will gradually be replaced by the finished tracks. The north tube was cut through in March, 1904, and has sidewalks now completed, to which the general public is admitted. The center of the tunnel is about 65 ft. below the surface of the Hudson river. Over the tunnel there is about fifteen feet of construction work and then about fifty feet of water. The north tube will carry the westbound tracks and the southern section will carry the eastbound traffic. It is intended to extend the tunnel on the Jersey side to the Erie Railroad station in Jersey City, and also to the Hoboken terminal of the Delaware & Lackawanna. On the New York side the tunnel passes beneath Morton street as far as Greenwich street, then north to Christopher street, thence easterly to Sixth avenue, and then to Thirty-third street, where there will be a station. A branch will continue to Astor Place on Fourth avenue, where a connection will be made with the Subway. The approach on the New York side extends already about 300 ft. under Morton street. Mr. Charles M. Jacobs, chief engineer of construction, states that the tunnels and the various branches leading to the same will be in full operation inside of a year and a half.

How the Mule Was Killed.

An army mule got killed as a penalty of trespassing on a railway in Manila and there being no fighting going on, a court of inquiry was held, the principal witness being a negro private. A pedantic snob of a lawyer officiated as prosecutor.

"Now," said he, closing his speech of instruction, "just tell the court in as few words as possible what you saw on the 24th day of June, 1900, while walking down the track of the Manila & Dagupan Railway about nine o'clock in the morning. Tell the court how the animal was killed and just what you saw. Don't use, now, all the words in the dictionary. Proceed."

The soldier looked puzzled at first—a perfect picture of stupidity. He frowned as though deep in thought. He turned his head on one side. He gazed toward the ceiling as if hoping for Divine inspiration. Finally his face lighted up faintly and he drawled out: "Well, Cap'n, hit jes' tooted and tuck 'im."

Railway Mileage.

According to recent railway statistics, the length of the railroads of the world was 537,105 miles on December 31, 1904, of which 270,386 miles were in America, 187,776 in Europe, 46,592 miles in Asia, 15,649 miles in Africa, and 16,702 miles in Australasia. Of the mileage of European railroads, Germany stands first (34,016), followed in their order by Russia (33,286), France (28,266), Austria-Hungary (24,261), the United Kingdom (22,592), Italy (10,025), Spain (8,656), Sweden and Norway (7,730). The average cost of construction of the European railroads per mile is estimated at $107,577, while for the remainder of the world the estimate is only $59,680. The total value of the railroads of the world, according to these statistics, is $43,000,000,000, of which the European roads figure for $22,000,000,000. The estimate for rolling stock is as follows, in numbers: Locomotives, 150,000; passenger coaches, 225,000; and freight cars, 3,000,000.

Forgot His Own Name.

Some months ago Dominick Maisonvitch, who had been working in the mines of the Lackawanna Company, hurried to Europe to bring over his wife and family, and neglected to draw his pay. The other day he returned, and remembering the undrawn money, made application for it. But to the amusement of the officials and his own consternation he could not remember the name under which he had worked. There are few foreigners who are known by their proper names in the mines, for the reason that so many of the names seem to be so similar that it is necessary to give them an English name. Dominick may recall his former payroll title in time. In the meantime he will be known as Mike Smith, although for a time he did think rather seriously of making it Mike Mitchell or Mike Roosevelt.

The incident reminds of a prompt way that a poor Pole received a new name from a roundhouse foreman. The man got a job as a wiper, and the morning he went to work the foreman asked, "What is your name?" "Batthyomi Popinalski, sir," replied the Pole.

"What the devil is all that?" exclaimed the foreman in wrath.

The name was repeated and the foreman said, "We don't want heathen names like that here. Your name is Pop Brady," and Pop Brady it was as long as the man lived.

The action of the managers of the Erie Railroad in purchasing control of the Cincinnati, Hamilton & Dayton Railway has been approved of by the stockholders. Further extensions of the company's holdings are proposed and forty-two miles of new roadways will be constructed between Highland Mills and Mount Hope, New York.

The Pennsylvania Railroad Company has decided to use steel passenger cars. This includes the floors, sides and roofs. They will weigh little more than the present wooden coaches. Several tests have shown that the steel cars cannot be telescoped, and the steel plates make them much stronger on the sides. The complete change of passenger cars will take about five years.

General Correspondence.

Austrian 0-10-0 Locomotive.

Editor:

I believe it will be of some interest for your readers to see that an almost identical type to that described and illustrated in your valuable paper of September, 1905, "Switcher for the L. S. & M. S.," viz., an 0-10-0 type, has been constructed from my designs in 1901 for the lines of the Austrian Imperial and Royal State Railways.

The difference is only that the said Austrian type is not a switcher, but a freight engine, designed to do the piloting or hauling the heavy coal and goods trains over our hilly roads in Bohemia, Styria, etc., over lines which, together with long grades of 15°, 17°, 22°, 25° and 33° represents curves as sharp as 190 to 200 meter radius.

The said engines are two cylinder compounds, with my starting device, no intercepting valve and no starting valve. The first of these engines was built in the Floridsdorf Locomotive Works near Vienna. To-day we have 115 of this class (called Series 180) hereby shown, in regular service and 10 in course of construction.

The Austrian Southern Railway has 12 engines of this class to work the freight trains over the "Semmering."

The earlier batches of these engines had the simple Hardy vacuum brake. The more recent engines have the automatic vacuum brake, improved by Hardy Brothers (sole representatives of the Vacuum Brake Company on the Continent), and by our Chief Engineer, Mr. F. Rihosek.

The engines have two lifting injectors, Systeme Friedmann, No. 9, Haushalter speed indicator, Holl Gresham steam sanding apparatus improved by Mr. F. Rihosek, two safety valves, coal system, valves and piping for heating the trains with steam.

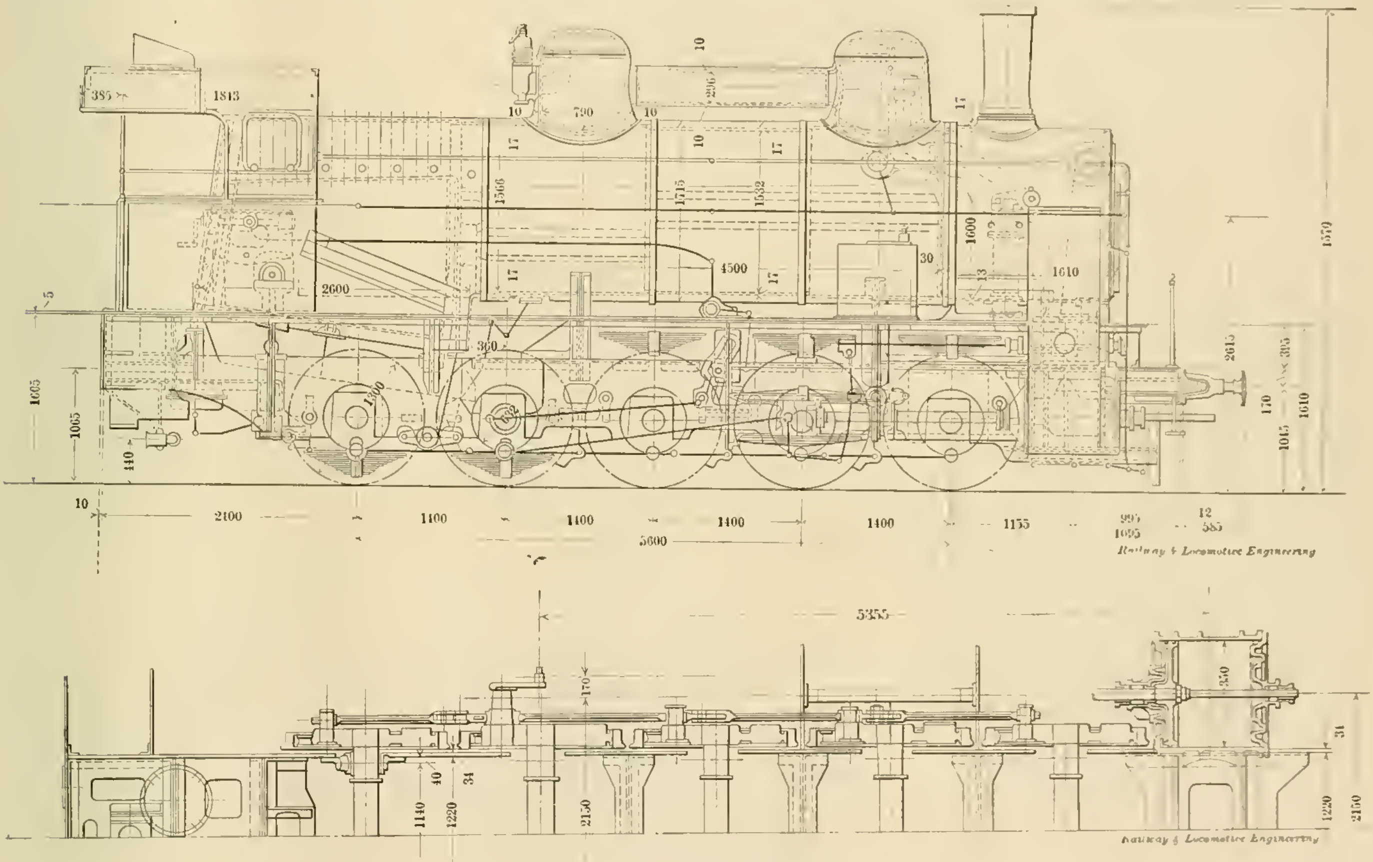
To enable the engine to pass the curves with the greatest freedom, the first and the fifth axle has a side play of one inch each side, the third axle a side play of three-quarters of an inch each side.

For the American people this will seem to be a small engine. But for us where the greatest axle load is limited to 14,500 kilograms (32,000 lbs.) and where, owing to the weakness of the bridges, this load especially for engines with close pitched axles, is subjected to a further restriction (in this case to 13,500 kilograms (29,500 lbs.) it is a very big one.

Considering the small wheel load, both the boiler capacity and the tractive force may be called very large.

KARL GÖLDSDORF,
Chief Council, Railway Ministerium.
Sauermanngasse, 4, Vienna, Austria.

Mr. Goldsdorf kindly sent us a recent publication containing engravings of a great many Austrian locomotives of the most recent build, from which the reproductions on the following pages were made.—Ed.



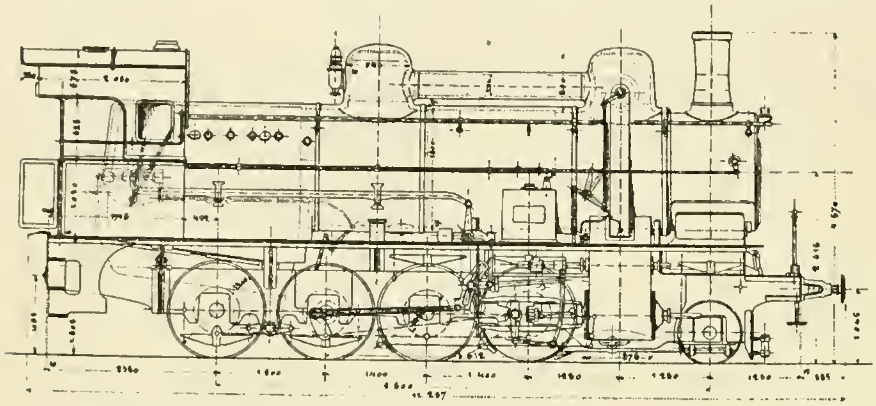
POWERFUL AUSTRIAN ENGINE.

Outraging Nature.

Editor:

In looking through the different numbers of the different accident bulletins issued by the Interstate Commerce Commission, the cause given for a goodly number of the accidents was sleeping on duty. While some of the reports do not make the charge outright, the inference seems to convey that meaning.

In bulletin No. 9, record No. 33, which refers to a rear end collision, in which 22 employees of a circus train were killed, the report reads in part as follows: "The engineer failed to have his train charged with air, and while still a mile off he failed to see a fusee signal which had been displayed on the track to stop him, and did not shut off steam until warned by the fireman who had seen the fusee. As the hour was about 3 o'clock in the morning, and as the engineman had not been sleeping during the time allowed him for rest in the preceding day, there is strong ground for the inference that he was asleep at his post," etc.



EIGHT-WHEEL CONNECTED FREIGHT LOCOMOTIVE FOR THE AUSTRIAN SOUTHERN RAILWAY.

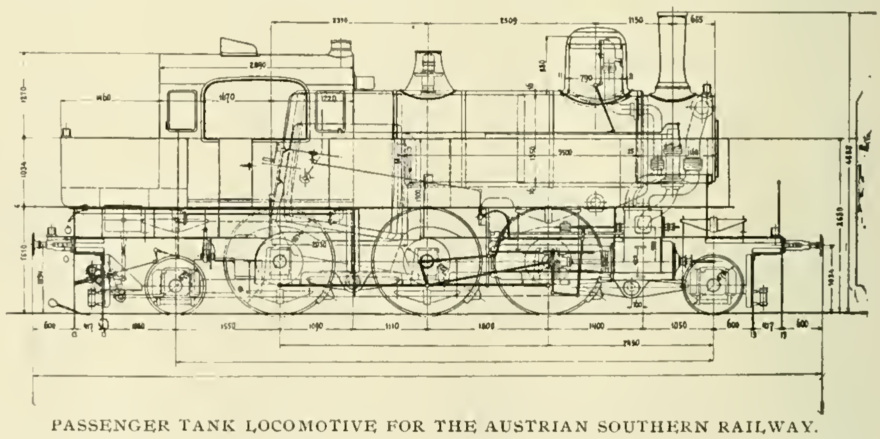
In bulletin No. 10, record No. 27, another rear end collision, which cost a loss of 32 lives, the company reports the leading train, which was an accommodation, standing at a station on the time of an express train following, and that brakeman assisted passengers from train before going back to flag, that he only got about 200 ft. back before the express was upon him. It is claimed by the officials that the tail lights on standing train could have been plainly seen 2,800 ft. in the rear, and the brakeman said no answer by whistle was given to his flag signal. The deduction to be derived from a report such as the last leads one to believe that there was a gross neglect of duty, or that the engineer was not himself at that particular place and time. It is my opinion that, while not so stated, the officers of that company believe the engineer was dozing at his post.

There are a number of cases reported very similar to the last named, and leads to the conslusion that were the enginemen of our railways always at their best, the casualty list on our American railroads would show a decided decrease.

In the first mentioned case the engineer is reported as not sleeping when he had the time to sleep. Now, in my opinion, if this particular railway company could find out after the accident that he neglected to take the rest, which nature required of him, they might have been able to have traced up his doings during the time allotted him for rest. Perhaps this engineer was on the show grounds that preceding day and may have been seen by some of the officers of that company; and if such might have been the case, why would it not have been clearly the duty of the official seeing him to demand a reason for his not being where he could be getting enough sleep to put him at his best before attempting to follow red lights the greater portion of the coming night, particularly when it must have been clearly known by all concerned that an accident to those trains would result in not only serious loss of life, but a property damage far above that usually involved in the average freight train accident.

Twenty-six years behind the throttle taught me some very valuable lessons, and were I to give to the world some of my experiences, trying to give good service after allowing myself to outrage nature's laws, it would have the "earmarks" of a romance.

When I first heard that various railway corporations were sending out spotters to find who were and were not patronizing the saloons, I felt quite indignant and so expressed myself to others. I took the ground that it was nobody's business what I did with my money, and that all the right a railroad company had to expect of me was to perform the duties for which I was hired. I have long since changed my mind, and to-day believe that constant supervision should be had over the engine and train men, particularly the engine men, when off duty. It is my opinion that a record should be kept of the latter named class of employees. There should be a constant surveilance kept on their movements, and when a man was found who continually violated every law of common sense, call him in and read his record to him and give him a very brief period in which to show decided improvement. If an engineer, as cited in the first case mentioned, was seen floating around the town during the day, when both himself and those in authority knew he was booked for an all night's duty, a very proper thing to have done would have been to mark up some other engineer, known to have had rest, for his run, and notify first man marked up that he could not go out, stating reasons. In future numbers of RAILWAY AND LOCOMOTIVE ENGINEERING I want to give my views as to numerous reasons why engine men become unfitted for their tasks. It is common knowledge that a lack of common sense on the part of the traffic department of various railroads is responsible for frequent loss of lives and great property damage. Too many hours on duty is a complaint almost universal, and corporations that cannot handle the safe end of matters for the men on the road have no right to expect they can revolutionize things by trying to handle their men when off duty.



PASSENGER TANK LOCOMOTIVE FOR THE AUSTRIAN SOUTHERN RAILWAY.

There are many causes for men being unfitted for so responsible a position as running a locomotive. It would take a dozen letters the length of this one to cover the ground fully. Having made a study of the conditions that confront the American engine man both on and off duty, it is no surprise to me to read of an occasional accident. It seems to me at times that it is nothing short of miraculous that we do not have double—

yes, triple, the number of railway accidents that we are now having.

J. W. Reading.

Grand Rapids, Mich.

Hardening Tools.

Editor:

Your excellent advice as to the working of tool steel, published in your last number, induces me to venture a few suggestions in regard to the hardening of tools. Much saving may be effected by the use of the best methods in hardening. The following are the most successful means that I have used: Cover the cutting-edge of the cutter or die with paste made from bonedust and crude oil. Let the work heat slowly to a cherry red. It is best to use charcoal and cover the work entirely over. Cool quickly and thoroughly, so that you can take the work in your bare hand, then get the work as soon as possible into the fire to prevent cracking of the steel. The work should be heated until sawdust thrown upon it will burn. The work can then be polished, and the temper drawn without any danger. In cases where it is not convenient to polish the tool with emery cloth or other means, a good plan is to rub soap over the face of the cutter when put into the fire for tempering. The potash in the soap will make the face of the metal perfectly white, when the desired temper can be readily drawn in the ordinary manner.

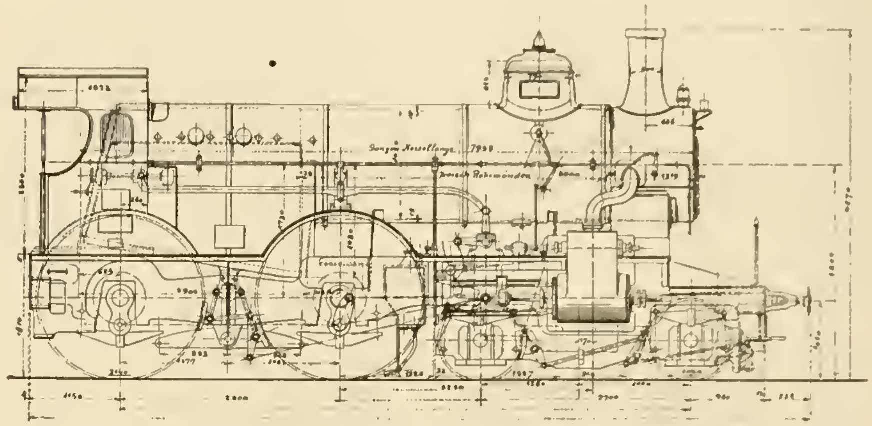
Thos. McNally.

Paterson, N. J.

The Balanced Throttle Valve Again.

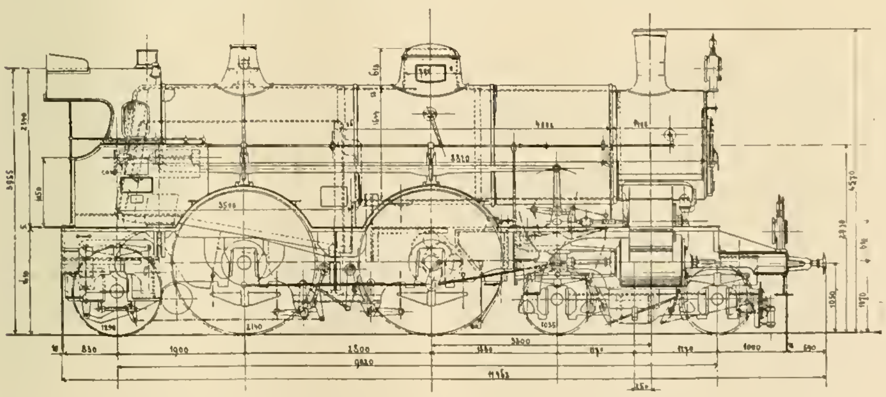
Editor:

Mr. Kennedy's remarks in the August number of Railway and Locomotive Engineering on grinding the Balanced Throttle Valve struck me as being very "pat"—indeed I might say that I considered the story the best of its kind I had read in many a day. The October number is now at hand, and I have noted Mr. Hawley's criticism on the original contribution. Grinding a balanced throttle is no "boy's job"; and what Mr. Kennedy says about the operator throwing his weight forward and downward upon the valve in the act of grinding is well worth considering. Whether one should throw one's weight upon the grinding handle depends very much upon the size of the valve in relation to the joint area; and the tendency of the valve to adjust itself to the seat in the act of grinding might depend very much upon the bulk of the valve as compared to the man who is doing the job. Hence a feather-weight machinist might have excellent luck with a very large valve, while a weary heavy-weight mechanic might develop in a small throttle valve all the defects described by Mr. Kennedy.



FOUR-WHEEL CONNECTED FREIGHT LOCOMOTIVE FOR THE AUSTRIAN SOUTHERN RAILWAY.

It is questionable whether extra weight thrown upon a throttle valve, or any similar piece of work in the act of grinding, is really beneficial. The excessive weight speedily crushes the emery, possibly before it has performed its full abrasive work.



FOUR-CYLINDER EXPRESS LOCOMOTIVE FOR THE AUSTRIAN SOUTHERN RAILWAY.

That neglect to shift the valve occasionally upon the grinding spindle results in flattening the valve has been too often demonstrated to call for further comment. And the absolute certainty of grinding a seat out of round when the mechanic does not change his position relative to the dome, is proven in the case of those engines whose domes are located so near the cab that there is no room for the grinder to post himself comfortably between the dome and cab; or where the cab is so located as to supply a convenient support for a tired artisan. In the former case the seat will be found to be low toward the back, and in the latter instance toward the front of the stand pipe. I might add that I have noted these defects time and again in the old locomotive days on the elevated roads in New York City.

Mr. Hawley seems to have been peculiarly fortunate in his experience with throttle valves. Possibly he has the knack of grinding valves himself and has not been very observant of valves ground by others. The writer recalls his own experience in the C. P. shop in Manitoba many years ago. One of the first jobs given me was a throttle valve to grind. The engine went out that day, and the following day the foreman came around, and with pretended wrath demanded to know what I had done to that throttle valve. I assured him that I had done nothing else to it than an experienced mechanic should have done; but he insisted that something unusual must have been done for it was "the only tight throttle that had gone out of that shop during that foreman's experience there. So I am convinced that well ground throttles have not always been the rule in the Northwest.

As for the tissue paper test, while it might be an excellent means of proving the valve to be of proper length, either when turning the valve in the lathe, or in grinding it to the seat, it would not, however, demonstrate that a valve was not ground out of round any more than the pencil marks would serve that end. *The high place in the seat might still match the low place in the valve.*

It is debatable whether there is anything in the idea of unequal expansion and the consequent allowance in the fit of the valve to offset or meet it. While it is a common practice to ease up the top joint to overcome the excess of expansion on account of greater area there are, or have been, shops in this land when the very contrary has been the practice.

I am inclined to agree with Mr. Kennedy, that the majority of throttle valve leaks are caused by valves being ground out of round. W. L. CALVER.

Interborough Rapid Transit Shops, 98th St. and Lexington Ave., N. Y. City.

Difference in Power of Two Engines.

Editor:

In regard to the question by Mr. A. J. Monfee in your August number relative to the difference in power of the 130 lb. engine, against the 145 lb. engine, I would say that the difference in power is due to the difference in thickness of tire, the 130 lb. engine having her crank 1⅞ ins. nearer to the rail than the 145 lb. engine, which gives the greater leverage in her crank.

P. WALSH,

Dennison, Ohio.

Reinforcing a Piston.

Editor:

The Northern Pacific Railway have a number of locomotives with extension piston rods that pass through the front cylinder head and ride in a brass sleeve in the head. This sleeve wears very rapidly, and after being turned upside down has to be renewed in a short time. The extension rod also wears flat on the bottom side, and when the sleeve and the rod are both worn the piston head drags on the bottom of the cylinder, and as the head is made of cast steel, the cylinder is worn very quickly.

An improvement was adopted recently which may be of interest to your readers. The sketch of piston head (No. 1) in the accompanying illustration represents the head of the old style with three flexible rings. No. 2 shows the new the new method employed. As will be seen, the center ring is done away with, the operation consisting of stripping the piston of its rings, putting it into the lathe and cutting out the intervening spaces between the rings and deepening the center space into a dovetail form, and also cutting off the front extension or tail rod. The piston is then sent to the brass foundry and the brass is cast onto the head in sections of 12 or 14 ins. It is then finished in the lathe, and the two outside rings fitted in their places as before. The head proper is turned about ¼ of an inch smaller than the cylinder, and the central brass part turned 1/16 of an inch smaller than the cylinder. The large brass bearing on the bottom of the cylinder shows very little wear, as has been shown by examinations of engine pistons of this style which have been in service for several months.

It may be added that, in addition to this change of bearing and removal of the extension rod, the keyway in the piston has been cut straight instead of tapering, the taper being all on the crosshead. This allows the piston when worn on the bottom side to be turned upside down, the straight keyway admitting of this change. The hole in the front cylinder head is neatly covered with a turned cast-iron plate.

J. W. PERCY.

South Tacoma, Wash.

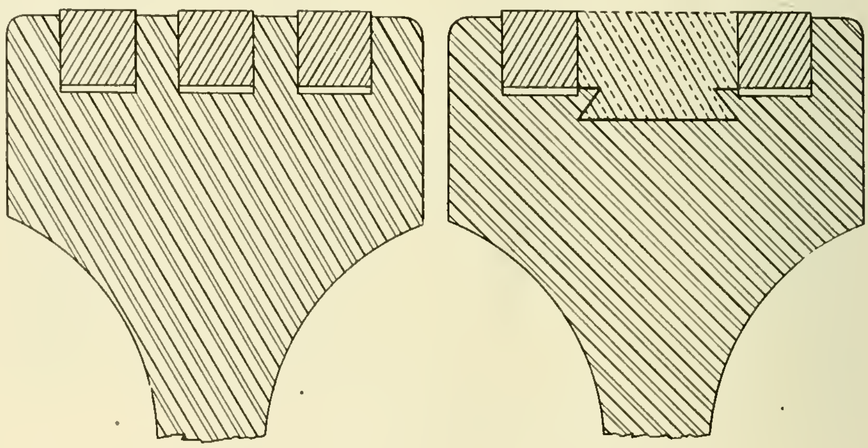
"High Speed" Steel.

Editor:

Your excellent reply to a question in regard to the working and tempering of steel was in every way proper as far as the use of carbon steel is concerned, but "high speed" steel can be worked at a much higher degree of heat than carbon steel. In fact, it should be worked at a bright red heat, the cutting edge to almost a white heat. Most steel makers now make "high speed" steel which is practically worked in the same way and heated to almost a white heat which would spoil ordinary tool or carbon steel. In the absence of an air blast oil may be used, and the tool should be shaken violently in the oil to cool as quickly as possible, as if the tool is held still the oil does not cool it very quickly. Great care must be used in hardening tools which have a sharp edge, as their sharp edges are easily melted off. In the case of lathe or planer tools it does not matter so much if their edges are melted off if facilities are at hand for grinding them into shape again.

WM. M. KINSMAN.

Hartford, Conn.



REINFORCED PISTON HEAD.

Lining Old Driving Boxes.

Editor:

In lining old driving boxes, shoes and wedges whose thicknesses are all different after being planed, what is the best and quickest way of finding center of jaws, front jaw straight, back tapers? Is it necessary to have both shoes and wedge same thickness at the top when finding jaw center? A. J. D.

We answer the above question as follows: The jaw centers between the front pedestals are usually marked by lines in the frames, which can be seen by scraping off the paint on top or sides of the frames. These centers are found and proved by two methods: first, by having a center mark on the saddle about the same height as the top of the frames, this mark to be made exactly central between the two frames. A tram is then adjusted to reach from this center mark to the center of the pedestal jaw. The exact center of the frame can be found by callipers having one straight and one bent leg. This frame mark can then be taken as a starting point for the subsequent operations. The front shoes should then be put in place. They should be the same thickness on the top as on the bottom and should be perfectly square with the frames vertically as well as horizontally. The wedges should then be put in position, and an adjustable bolt placed between the wedges and shoes, holding them firmly in place. A straight-edge should then be placed against the faces of the two wedges, and from this straight-edge it can readily be discovered if the wedges are exactly square with the frames. The wedges may be tried also by having a line stretched through the cylinders, an ordinary 2-ft. square showing on the cross straight-edge and lines if the two sides of the engine exactly correspond. Measurements can then be made from the center of pedestal jaws to face of shoes, and also from the cross straight-edge to face of cylinder heads, or, in the absence of the cylinder heads, to the joint of cylinder heads on the cylinder. The measurement from the line of the shoes to the cylinder is merely advisory, and the shoes should not be changed by liners to accommodate themselves to any variation, as the cylinders are not always exactly parallel to each other. The best guide is, if a line is stretched through the cylinder and the line is perfectly parallel with the frames and the shoes square perfectly to the lines, it is safe to proceed, presuming that the shoes and wedges are perfectly straight to each other across the frames, as well as callipering exactly, with perhaps a slight degree of tightness at the bottom. The driving boxes should then be tried in their places before being placed on the axles. When in place, pieces of wood can be jammed tightly across the outer bearing of the box and a small piece of tin attached with an exact mark of the location of the center. At this time it will be readily seen if sufficient liners have been used to reinforce the shoes and wedges, the mark on the pedestal jaw can also be readily compared with the central mark on the piece of tin by cross straight-edge and square or plumb-line. It is a good rule at this time to know what is the proper distance on that particular class of engine from the end or center of the cylinder to the center of the front axle. The nearer this conforms to the drawing, the less trouble there will be in adjusting the main and connecting rods. It need hardly be stated that in making any changes in liners the same thickness of liners should always be placed in the front shoes, the variations of thickness, if any, to be attached to the movable wedge. It is good practice to rivet the liners securely to the shoes and wedges, particularly to the wedges. The front boxes being exactly adjusted, the others follow at the exact distances required by the length of rods. It will generally be found that in repairing engines the shoes are worn in length, and it is a good practice to rivet pieces across the bottom of the shoes and carefully readjust the shoes to the exact length by screwing up the binder, leaving a thickness of paper or more to jam the shoe securely in place.

The operation is altogether one of the most important in locomotive repairing, and it is impossible to give complete details in a letter. We have given the salient features of the operation, but recommend to all who would attain to a mastery of the subject a study of the "Twentieth Century Locomotive," published by our company.

Picture of Railroad Wrecks.

We do not remember of any railroad dignitary who is so powerful as Mr. James J. Hill in the composing of epigrammatic expressions; that is, the power of saying striking things in few words. About the current agitation on governmental regulation of railroad rates Mr. Hill says:

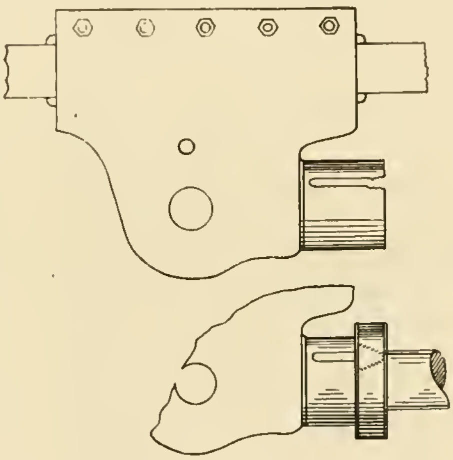
"I am not afraid that any federal regulation will ever get down deep enough to touch us where we live, because long before they do the country will be strewn with railroad corpses. They would bankrupt two-thirds of the mileage in the United States."

The picture brings to the mind fragments of railroad property lying about as we used to see the heads of departed buffaloes strewn upon the plains.

Repairing a Crosshead.

Editor:

The method proposed by a correspondent in last month's Railway and Locomotive Engineering in securely attaching pistons and crossheads is an excellent device, although it seems to me that it would be somewhat costly; besides, in some classes of engines the space between the crosshead and piston packing box is so small that there would not be sufficient room for the brass sleeve and large nut as described. In regard to repairing crossheads where the piston has drawn the piston rod out of the crosshead, tearing the key



REPAIRS TO A CROSSHEAD.

through the end of the boss, we had several cases of that kind on the Brooklyn Elevated Railroad where we had no engines to spare and something had to be done speedily. The accompanying sketch will show how we got over the difficulty. The part back of the keyway, which was torn out, was cut to a V-shaped section, and two pieces of steel were carefully fitted in. A wrought-iron ring was then shrunk on, covering the two pieces and also preventing the crosshead from opening further when the piston was attached and the key driven to its place.

Ed. Somerville.

Brooklyn, N. Y.

Steam vs. Gas.

The corporation of Glasgow, Scotland, have adopted a report from a committee who have been studying the question of the mechanical power to be used in connection with the new sewage works. The committee recommend the adoption of steam power, not that the gas may not be superior to steam power for some purposes, but because it is not superior for the purpose in view. The committee believe that with steam the coal bill will be as small as with gas, but that the working costs, especially in the matter of oil, would be higher for gas producer plant than for boilers and steam engines.

Car Shortage.

From all over America reports of car shortage are heard, the Pittsburgh district, perhaps, experiencing this difficulty the most. The New York Central and the Baltimore & Ohio have placed an embargo on their cars and refuse to send them to other roads. The order is especially aimed at coal shippers, and trouble is already experienced in bringing coal to the seaboard. Some of the roads have an abundance of cars to take care of their own shippers, but are determined not to allow other lines to cater to their shippers with another company's rolling stock.

Changing to Oil Burners.

The Southern Pacific Railroad Company are having all of their big locomotives on the Sacramento division equipped with oil-burning apparatus. Storage-tanks for oil fuel are being installed at Rocklin, Gold Run, Sparks, Nev., and at other places. The company find oil much cheaper than coal, and by November it is expected that the change of equipment will be completed. The firemen are much pleased with the change.

Orders for new locomotives for the Northwest are reaching proportions beyond any previous experience. The Northern Pacific has just placed an order for 80, the Canadian Pacific, 35 switching locomotives, the Michigan Central 15 consolidation locomotives. These orders involve the reconstruction of 16 new bridges.

The Missouri, Kansas & Texas Railway has just received 30 large locomotives that are being distributed over the Texas division. They are all inside connected and are said to be making great records for speed. There are also near completion 2,000 box cars for the same road.

President Hill, of the Great Northern Railway, and President Elliott, of the Northern Pacific, have been making an extensive survey of conditions in Oregon. Plans are approved of by them for vast terminal facilities on the Pacific coast.

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The Burning of Fuel.

It is a long time since people began to burn coal in furnaces, and many of the brightest scientific minds have investigated the phenomena of coal-burning in small and in large masses, yet there remains many things connected with the combustion of fuel that seem to be mysterious. All are familiar with the fact that when various materials known as fuel are raised to a certain temperature they will proceed to burn and give forth heat, but what proportion of the heat can be made available for industrial or domestic purposes is a matter of uncertainty, and authorities differ largely as to the best means for obtaining the greatest amount of heat from the fuel.

One pound of good bituminous coal contains about 14,000 heat units, which if entirely utilized would be sufficient to raise about 95 pounds of water from 65°, the tank temperature, to 212°, the boiling point; but in practice half of that is considered fair performance. The remainder of the 14,000 potential heat units goes off in waste gases, by radiation and through other sources of waste. The aim of engineers and of people who burn fuel for commercial purposes, is to convert as much as possible of the heat into useful work, but there is great conflict of opinion as to how this can best be accomplished.

D. K. Clark, the famous investigating engineer, Fairbairn and others held that concentration of heat in the combustion of fuel produced the most satisfactory results, but modern heat engineers advocate different practices. One of Clark's axioms was that too much fuel could not be burned per unit of time and grate so long as the proper mixture of the combustion gases went on. Modern engineering calls for slow combustion and the providing of sufficient grate area to eliminate as far as possible the necessity for forced draft.

In *Locomotive Sparks*, Professor Goss says: "Soft coal upon a grate in the open air will burn at about the rate of three pounds an hour for each square foot of grate surface. In a heating stove, under the usual conditions of draft, there will be burned about five pounds for each foot of grate, and under a stationary boiler connected with a good stack, the rate may increase to ten or even twenty pounds per foot of grate. Again in naval practice, with a closed stoke hole and draft forced by blowers, the rate of combustion is occasionally carried as high as fifty pounds per foot of grate per hour; but this value may be accepted as the maximum rate at which fuel is burned for the purpose of generating steam. Under the highest service incident to common practice in the narrow fire boxes of locomotives, the rate is between fifty and one hundred pounds, and good practice allows it to rise above one hundred and fifty pounds or three times the rate attained under conditions of forced draft in naval service.

"In spite of the gradual increase in grate area, rates of combustion per unit of grate area have not greatly declined in recent years. Such progress as may have been made in securing enlarged grates, has done but little more than to keep pace with the increased amounts of fuel, which as engines have increased in power are required to be burned."

That is a comprehensive description of the amount of fuel burned per unit of grate under extremely varied conditions, but it does not deal with the efficiency of combustion under varying conditions, but reports made by Professor Goss of tests made on the locomotive testing plant at Purdue University seem to show that the greater the amount of fuel burned per hour on a unit of grate area the smaller becomes the proportion of heat imparted to the water in the boiler. The publication and discussion of facts to this affect have no doubt exercised influence in promoting the movement to make grates as large as possible. The policy in regard to enlarging grate area is similar to the construction ideas of a pioneer locomotive superintendent the writer had much to do with. The chief draftsman was talking about valve stems breaking. The superintendent remarked, "Make them so strong that they can't break, then make them a little stronger."

We have the most profound respect for the teaching based on experiments carried on with testing plants, but road experience seems very often to produce results decidedly different from those of the testing plant. There is a class of express locomotives belonging to the Pennsylvania Railroad that are operated with part of the grates bricked over. Not only do these engines steam more freely with the restricted grates, but they burn considerably less fuel than they need when the whole grate area is used. Complaints are common that large grate area engines are extravagant in the use of fuel, but no railroad company except the Pennsylvania seems to have tried the effect of reducing the grate area.

All railway men who have investigated the matter thoroughly are convinced that European locomotives perform work with materially less fuel than American engines. The leading difference in the dimensions of American and European locomotives is that the latter have from 25 to 33 per cent. less grate area than the former. It seems to us that this fact alone ought to receive serious consideration and investigation. There may be more in the old time theory concerning the advantage of concentrating heat than modern teaching admits.

Every man who has run a variety of locomotives can easily understand how large grate area may cause loss of heat. The use of numerous hollow stay bolts that ran its course as a fad a few years ago, ought to be edifying to those who are trying to find out how very large grate area is not satisfactory.

Home Building by Railroad Men.

In the days when a railroad company seldom had more than one thousand miles of track, the managements displayed considerable paternal sentiment towards the employees, and one manifestation of this interest was the advising men to form building societies to encourage the building of houses for the members. The argument that every married man ought to be the owner of a home was one which appealed to the very best class of railroad men, and they were generally quite willing to devote their savings to such a laudable enterprise. The managements of many railroad companies perceived that it was to the advantage of their employers to have employees owning their own homes, and it was a common thing for the railroad companies to extend substantial aid to the home building schemes. Men having their own homes at a division point were likely to be more conservative when trouble arose than those who were always in light marching order.

We do not blame railroad officials who pursued this policy of encouraging their employees to provide themselves with homes. Most of the officials followed the same policy with their own savings and became home owners. They did not foresee that the ownership of railroads was ever going to change materially, and that great aggregations of capital would ever bring about consolidations putting tens of thousands of miles of track under one management. They supposed that division points were established for all time and that their property would be secure in value as long as the railroad they worked for was kept in operation.

These people reckoned without their host in the form of an all-embracing, all-devouring railroad magnate. The men of commanding wealth have come and they entertain no sentimental considerations of leaving division points and workshop locations unchanged. All they think about is getting the highest interest possible on the capital invested in securing control of the properties, and there is no hesitation in making radical changes that entail financial distress upon the property holders among their employees. Within the last five years there have been many shops closed and division points moved that inflicted rank injustice upon thousands of people. And this has frequently happened to places where much capital was invested depending upon the good faith of the railroad company, and in not a few cases public burdens were assumed to aid the railroad company to secure right of way and land for the location of their works.

Notwithstanding the loss and hardship that railroad employees have endured, this loss of value of their property, owing to the arbitrary changes made by new railroad managers, we are informed that workmen and others employed at new locations are being encouraged to favor and support new home building schemes.

Our advice is to go very slow in a matter of this kind. If the railroad shops assume that magnitude of outlay which gives an apparent certainty of long continuance, or if the location has other great and growing industries which are certain to give employment to a constantly increasing number of skilled working people, a home in such a locality is a good thing under any condition, but unless these qualities alluded to are present in a marked degree, it is wiser to keep on making deposits in a savings bank. United States bonds, which can be readily procured at denominations of one hundred dollars or more through any respectable financial exchange office, or at any branch of the United States Treasury Department, are an investment over which one need not lose any sleep, and to the purchase of which we would much rather recommend the attention of the industrious railroad man, than the building of a house beside some remote roundhouse.

Metal Ties.

When talk becomes serious about the disastrous destruction of forests rendered necessary by the demand for railroad ties, we generally hear the assertion made that iron and steel will soon come into general use as material for ties and that the forests will then be permitted to grow in peace, free from the sound of the woodman's axe, so far as the call for railroad ties is concerned. This story has been told for the last thirty years, yet very little progress has been made in sparing that tree. In Europe, where wood suitable for ties is scarce and dear, various persistent attempts have been made to introduce iron and steel substitutes with very unsatisfactory results. Metal to metal does not make a good combination, with the result that metal ties are noisy and do not hold the rails so secure as wooden ties. All sorts of shapes have been tried, but a fair substitute for the wooden tie has not been found.

In Italy and France a disked steel tie has been applied to many miles of railway track, but the tie is noisy and requires much attention to maintain the fastenings from falling apart. So noisy is the impact of tie and rail that the jar adds decidedly to the discomfort of railway travel. Those responsible for the permanent way, confess that the only merit possessed by metal ties is cheapness compared with wood. Very little experience with metal ties convinced British engineers that they could not dispense with wood, and their efforts for years have been directed to treating the wood so that its life might be protracted as much as possible. In this they have been very successful, and it behooves American engineers of track to follow the lead of their British compeers and to permit inventors to labor on the problem of producing a noiseless metal tie that will hold the rails securely without constant attention.

Meanwhile the report of the chief engineer of the Pennsylvania Railroad on steel ties is worthy of general attention. That company has experimented with steel ties to find out for themselves the merits and shortcomings of the same. The report raises the following objections:

(1) Increased expansion and contraction in all parts of the track; (2) they weigh about one-half as much as wooden ties, and do not make heavy enough track; (3) the connection of metal and metal between the rail and the tie is very detrimental; (4) they are noisy; (5) they have not the elasticity or cushion that a wooden tie has; (6) they cost more; (7) they could not be used where automatic signals are used, because they would make an electric connection between the rails.

Elevated Collisions.

The painful frequency of collisions on the Elevated Railroad in New York since the introduction of electricity does not reflect much credit on the present management. These collisions, although insignificant in magnitude of disaster compared to the appalling catastrophe which occurred in September, when a car full of passengers was dashed into the street, are nevertheless equally indicative of cheap methods and cheap men. In the early part of October a heavy laden flat car standing on the elevated track was struck by a motor car in the hands of a "green" motorman. The blow was of sufficient force to send the flat car away along the track at a speed that rapidly increased owing to a down grade. Fortunately a string of "empties" received the impact of the flying "flat," and while the damage was considerable, no one was hurt. A few days afterward, while proceeding to the yard at 185th street, two other trains of "empties" collided, instantly killing Jacob Eury, motorman of the rear train. Doubtless the disaster would have been much greater, but it came out in the evidence before the Coroner that the guards had all left their trains except two "green" men. This is a sad falling-off from the kindly discipline that existed during the management of the late Col. F. K. Hain. The economy of the present management is extravagance in the end. If they would pay better wages, there would be better service.

Neglecting to Take Necessary Rest.

We recommend all concerned to read carefully the letter on "Outraging Nature," by Mr. J. W. Reading in our Correspondence Department. The practice so common of men neglecting to take sufficient rest between trips has no doubt been the cause of many serious train accidents; for sleepy men in the cab are in no state to maintain the vigilant outlook that the strenuous condition of modern train operating demands. We believe that a process of reasoning together among the officials in charge of train operating and the men who do the work, would induce many of the latter to be careful in taking the necessary sleep as opportunity offered. Our experience leads us to believe that many men fail to take sleep and rest through a careless sense of the demands that will be put upon their vigilance and careful attention. After coming off a trip, say, in the morning, a man feels fresh and wakeful after a good wash up and breakfast. Feeling that way, the duty of taking sleep and rest does not seem imperative. He walks out to look about and encounters distractions that take his mind away from the toil to come; the hours pass fleetly and all too soon the caller makes his appearance and a worn out, drowsy man takes his place upon the engine.

It looks to be rather a cruel thing for official orders and vigilance to be pursuing men during their leisure hours, but it would be a kindness to many thoughtless train men if they had the consciousness that vigilant eyes were likely to be watching how their off duty hours were spent. The writer has wasted many hours of the day and night foolishly and suffered the penalty during weary hours on the engine when keeping awake was next to impossible. Looking back he reflects that a little supervision from the officials would have prevented much misery.

Cost of Stopping Trains.

Making careful observations of the extra coal burned making "no nothing" stops at crossings, convinced the writer many years ago when he was running a locomotive, that the introduction of interlocking block signals which would render stopping at crossings unnecessary would pay railroad companies a better return on the investment than any line of saving within his knowledge. The subject was repeatedly ventilated in the pages of various publications, but the opinions expressed appeared to fall upon unresponsive minds. Feeling as we have long done on the subject, we are pleased to find that it was ably presented to the last meeting of the Railway Signal Association, in a paper prepared by Mr. J. A. Peabody, signal engineer of the Chicago & Northwestern Railway.

Mr. Peabody investigated the cost of stopping certain trains on the Chicago & Northwestern Railway and got others to make similar investigations on other western railroads. The cost of stopping a train of 530 tons, and returning it to a speed of 50 miles an hour, he found to be 42 cents. The cost of stopping a 2,000 ton train from 35 miles an hour he estimated to be one dollar. Another road estimated each stop of a six car passenger train from 45 miles an hour to be 35 cents and for a 1,500 ton freight train from 15 miles per hour as 56 cents. The time lost for making a stop on a straight level track was estimated at 145 seconds.

The aggregate of this extra cost for stopping trains is considerable and the possibility of saving this expense is worthy of more consideration than it has ever received. The direct cost of the stops do not by any means represent the whole of the outlay. The wear and tear of driving wheel tires at starting deserve some consideration and the frequency with which draft attachments are pulled out is often the cause of delays that disturb the train movements of a whole division.

The work which Mr. Peabody has done in directing attention to the cost of making unnecessary stops is highly creditable to his enterprise, but the matter ought to have the careful and systematic attention of railroad officials who can arrange for the investigations being carried out in the most thorough manner. Many expensive investigations are made of things that have no money saving possibilities. Railroad companies struggle fiercely against any legislative move to increase the force of trainmen, yet the extra cost of useless stopping which would pay the wages of many extra trainmen receives no consideration.

Hauling the President's Train Free.

There has been considerable sensational writing for several weeks about the iniquity of the President of the United States accepting from railroad companies the use of a train to travel in without payment being made for the courtesy. The tone of certain railroad journals proclaims that the railroad companies which supply the trains are suffering under a grievous imposition.

We do not think that the people of the United States act fairly in requiring the head of the Government to accept free transportation from railroad companies; but the companies that enjoy the honor of providing a President's train receive more than an equivalent in advertising. Some of the railroad officials may regard the expense of running a President's train over the road as sheer waste of money, but the general passenger agent looks upon the enterprise from a different standpoint. A railroad which the President of the United States is delighted to ride over, is one that many ordinary travelers will prefer to rival lines. "The railroad the President traveled over," has a revenue making sound and the men who are loaded with the duty of attracting passengers do not overlook its potency. If the president of any railroad has supplied a whining memorandum about the hardships of hauling President's trains free, he was a lamentably poor creature. We doubt of his existence.

A Shining Example.

Ten thousand men in the employ of the Baltimore & Ohio Railroad are getting an increase of wages amounting to nearly 10 per cent. There has been no threatened strike, no cantankerous committees, no pitiful petitions, no grievances real or unreal. There has been perfect peace—the peace that spreads its white wings over employers and employees when they know that their aims and interests are identical. The year has been a busy one. The heavy harvests and rich mines are sending their treasures along the great highways of commerce to the seaboard cities and the arteries of commerce are crowded as they never were crowded before. It is but natural and proper that the thousands of skilled artisans by whose cunning hands the vast machinery is kept in motion should be sharers of this bounty in the distribution of which their work is of so potential a kind.

The reports of all the railways show increased earnings and vast surpluses, but they do not all show an increase of wages. The example of the Baltimore & Ohio is worthy of the imitation of all who are concerned in the best welfare of these railroad properties. Labor well paid has its reflex in work well done.

How Boiler Inspection Law Was Made Inoperative.

The New York State Legislature generally poses as being highly favorable toward organized labor, but when the favors granted are reckoned up at the end of each session, those to be benefited have good reason to exclaim, "Much cry—little wool." The railroad section of organized labor made a very vigorous demand last session for the Legislature to establish a system of inspection of locomotive boilers. The pressure could not be resisted, and a measure was passed, but the Little Joker got in his work by omitting an arrangement for paying the salary of the inspector. Those who were euchred in that deal are beginning to find out that the omission of the provision for paying the salary was not accidental.

The Penalty of Privacy in Railway Travel.

The current "tales of travelers" would lead our people to believe that the cars which are now used on British and Continental railways are long corridor coaches similar to American cars, but having the passage on one side. There are corridor cars used on most lines for through traffic, but the great mass of passengers are still carried in compartment cars which admit of no communication with trainmen. This exclusive method of travel has given ruffians opportunities to rob and murder people in the trains, and there are periodical agitations in favor of a change, but these soon pass off and the compartment carriage maintains its place and offers new inducements for outrages.

The latest exciting incident resulting from the privacy fad was the murdering of a young woman on a Southwestern Railway train. The assailant threw the woman out of the train in a tunnel and no trace has been found of the murderer.

A Genuine Hero.

The heroes of the rail are generally men taking part in the jeopardy of train moving; the office man has rarely the opportunity to perform acts worthy of record in the roll of imperishable honor. We have now to tell about a man who dared death in its most hideous form and sacrificed his life to his sense of duty. This was John Lindsey, telegraph operator at Lake Providence, La., who died at his post. When the other railroad men left, Lindsey stuck to his post because the telegraph offered the only means of communication with the outside world by which demands for physicians and medicines could be made.

He was taken sick while at his instrument, but would not desert until he had sent off the list of deaths and new cases.

In renewing his subscription for Railway and Locomotive Engineering, and saying a variety of pleasant things about the paper, one of the Chilean students at the Baldwin Locomotive Works writes:

"I take the opportunity to thank you for the attention of inserting in your journal a paragraph about the Chilean young men attending the Baldwin Locomotive Works, as I am one of them. We are six only, and have been sent here by the Government to obtain practical acquaintance with railway and locomotive construction. The idea of the Government is to employ us in the construction of railways on our return, which will be a couple of years more. We have to work here in the shops with overalls on, the same as other workmen, and we receive the same kind of training as young Americans do. We are under the care of Sr. Joaquin Walker Martinez, Chilean Minister in Washington."

When people read that the general passenger agent of a railroad is devoting much time to studying the best forms of gasoline motors for light passenger service, they incline to think that somebody is infringing on the duties of the superintendent of motive power, and they naturally suggest that the real duties of a general passenger agent are too trifling for the entire attention of one man.

A party of German railroad engineers have arrived in the United States for the purpose of studying American lines. They will publish an exhaustive report on their return, and the State railway department will doubtless adopt many of the American improvements.

A Lehigh & New England Rebuild.

Through the courtesy of Mr. H. C. Shields, master mechanic on the Lehigh & New England Railroad, at Pen Argyl, Pa., we are enabled to illustrate a good example of an engine rebuilt on that road. We are able to show this machine in two views, the proverbial "before and after taking" the course of treatment prescribed by Mr. Shields in his shops at Pen Argyl. The engine originally was a plain every day consolidation with cab at the back, ornamental dome and regulation tender. Her weight when taken into the shop was about 95,000 lbs., but when turned out, the treatment she received had added over 35,000 lbs.

LEHIGH & NEW ENGLAND ENGINE REBUILT—BEFORE AND AFTER

H. C. SHIELDS, Master Mechanic. L. & N. E. R. R. Rebuilders

The engine is simple, with 20½x24 in. cylinders and 50 in. drivers. A stiffening piece, consisting of a 1¼x4 in. steel slab has been placed on the top frame rail, and this stiffener takes all the frame bolts as well as those required to properly secure frame and stiffening piece together. The original frame was 3x4 ins. The wheels and running gear are practically as they were before, the leading and trailing drivers alone are flanged and the springs for the leader and intermediate drivers are overhung. The valve gear is the usual indirect type and actuates balanced slide valves. The valves are set with 1/16 in. lead, 1 in. outside lap and ⅛ in. inside lap.

The principal change has been effected in the boiler which has been enlarged and raised up considerably. The original boiler had a 54 in. shell with deep fire box measuring 96x35 ins. and carried a steam pressure of 125 lbs. The new boiler has a 59 in. shell and wide fire box, which latter is 103 ins. long by 84¼ ins. wide, giving a grate area of about 60 sq. ft. The fire box side and crown sheets are all in one piece and the mud ring corners are double riveted. The water space about the fire box is 3½ ins. at the sides and 4 ins. front and back.

In order to place this enlarged, wide fire box boiler in position a cast iron extension piece about 20 ins. deep has been placed between the smoke arch and the cylinder saddle, which when securely bolted to each makes a very satisfactory arrangement and secures the prolonged life of the cylinders. An extension to each of the steam pipes has also been made, and these together with an extension piece supplied to the exhaust has provided for the use of the old steam and exhaust pipes.

The cab has been centrally placed; as a matter of fact, it is just in front of the dome and this plan enables fire box staybolts to be easily examined and renewed without lifting the cab. The air pump has been placed on the right side behind the cab, in which position it and the pipes do not in any way obstruct the engineer's view, yet are within easy reach if either should require his attention. For the convenience and safety of the enginemen particular attention has been paid to the position of steps and handholds, three steps having been placed on each side between front cylinder cover and buffer beam.

The capacity of the tender has been increased so that the tank now holds 4,500 gallons and the fuel carried is 10 tons. These rebuilt engines are being used in mixed and freight service and are giving every satisfaction.

General Electric Company Awards at Portland Exposition.

Announcement is made that the Superior Jury at the Lewis & Clark Exposition has approved the following awards in the Electrical Department, relating to the exhibits of the General Electric Company, which is the largest manufacturer exhibiting in that Department.

The highest award granted by the Jury is a gold medal. This company received a gold medal for the best exhibit in the Electrical Department and gold medals on each of the following features of this exhibit:

1. Curtis Steam Turbine.
2. Meters and Instruments.
3. Time Limit Relays and Oil Switches.
4. Switch Boards, Meter Controlling Panels, Circuit Breakers and Lightning Arresters.
5. Direct and Alternating Current Meters.
6. Direct and Alternating Current Generators.
7. Static Transformers.
8. Automatic Voltage Regulators.
9. Magnetite Arc Lamp.
10. Alternating and Direct Current Enclosed Arc Lamps.
11. Mercury Arc Lamps.
12. Magnetic Starting Device for Mercury Arc Lamps.
13. Mercury Arc Rectifier.
14. Railway Motors and Controllers.
15. Mining Locomotives.
16. Searchlight and Method of Control.
17. Progress and Development in the Art.

For its new Metalized Carbon Filament Incandescent Lamps, the company also received a gold medal.

This Exposition, in common with all the recent American Expositions, is lighted by Edison Incandescent Lamps, furnished by the General Electric Company. A very unique feature was the extended use of Meridian Lamps.

New Publications.

The Proceedings of the Sixth Annual Convention of the American Railway Engineering and Maintenance of Way Association, held in Chicago last spring, have just been published under the direction of the Committee on Publications. The volume is the sixth of its kind, and extends to 900 pages, octavo. The subjects treated of embrace the entire field of applied mechanics in railway engineering, and take the form of reports of committees. Especially noticeable among others are the reports on Wooden Bridges and Trestles, Roadways, Iron and Steel Structures, Signaling and Interlocking, Yards and Terminals, Water Service, Masonry, Ballasting, Signs, Fences, Crossings and Cattle Guards. These and other important subjects are treated with marked ability and with a minuteness of detail that leaves nothing to be desired. The discussions on the various papers are also published and form a very interesting feature of the work. The book is illuminated with numerous illustrations and diagrams, and forms altogether a unique and valuable addition to the railway literature of our time. The drawings are fine, and the letterpress is an excellent example of the printer's art.

What's In a Name?

The craze for manufactured names of towns has struck our northern neighbors and a pretty little town on the shores of the Lake of the Woods has given up a time-honored, though not very elegant, name for one containing secret information for those who can read the writing, and make known the interpretation thereof. On the later time-tables of the Canadian Pacific the name of Rat Portage, Ontario, is replaced by that of Keenora, and this is the significance of the change. Rat Portage was called so after the muskrat, which the early voyageurs found while making a portage at this point, and the name did duty until recently. There are now three little towns in the vicinity and a contribution of a few letters from each name have built up the word Keenora. There is, of course, the original Rat Portage; nearby is Norman and also Keewatin. The first three letters from Keewatin, followed by the first two from Norman, and the first two from the word rat make the euphonious "Indian" name Keenora. Some of the old inhabitants want to hold on to the rat, while the more modern want the new name. The government, however, has altered the name of the post office and the railway uses the built up name on its timetables, and the rodent has permanently disappeared.

An agreement has been entered into by the Pennsylvania Railroad Company and the Interborough Railway Company, of New York, so that Long Island Railroad trains shall operate through the Subways of New York City. When the Pennsylvania Railroad Company perfect their plans for building great docks on the eastern point of Long Island, passengers for Europe will be able to go direct to the docks from any point where Subway trains stop.

The Canadian Pacific Railway Company are providing dining accommodations for their five or six thousand employees at the Angus Shops near Montreal, where a square meal can be had at cost price. The experiment in this direction at the works of the American Locomotive Company, at Schenectady, was very successful.

The Syracuse & South Bay Railroad has just been opened. Several weeks will elapse before the track is properly ballasted, and in the meantime the construction of the second track is being pushed as rapidly as possible. The track extends from Syracuse to the Oneida Lake terminus, and passes through a rich and beautiful country.

The Central Railroad Company of New Jersey has placed an order for 1 000 steel gondola cars with the Cambria Steel Company. The cars will cost $2,000 each.

The fact that railroad companies are prosperous and pay their current indebtedness promptly is good cause, some people think, why they should have their revenues reduced.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us. All letters intended for Our Correspondence School ought to be addressed to Department E.

Help Us to Help You.

We begin this month publishing a series of arithmetic lessons by Mr. Fred H. Colvin, who is an excellent instructor in that line. If our young readers will make use of the instruction given in this department and apply it to the numerous practical calculations that come up in the daily life of every mechanical man, they soon will be able to solve any problem presented to them.

We have met with demand for instruction in connection with the lessons we have been publishing. It is becoming a regular thing nowadays for railroad companies to have a code of questions prepared for the examination of trainmen. The questions are copied from the books of Sinclair, Conger Thompson, Blackall and other authorities on rolling power, mechanism and practice, but put in different words. Our course has answered all the questions in every code of the kind we have seen. Now the trainmen of the different roads are sending us the questions with requests that we answer them. We must really urge that these people do some mental labor for themselves and study out our answers so that they may be able to answer for themselves the questions put in a slightly different form.

The Ambitious Man's Catechism.

Continued

BY ANGUS SINCLAIR.

20. What is cohesion?

A.—A force that acts upon the particles of substances and binds them together in a fixed relation to the material acted upon. The form, solidity, hardness, elasticity, brittleness, malleability and ductibility of solids are the result of modification of cohesive force. The force of cohesion is manifested in liquids by what is called capillary attraction. This form of attraction causes water to cling to a glass rod or tube and rise above the natural level. It also makes oil climb up a worsted siphon and lubricate surfaces above the level of the oil supply.

21. What is adhesion?

A.—It is the action of a force similar to cohesion but is generally less powerful and is the attraction exerted between particles of two different bodies when placed in contact with one another. Paint and similar substances stick to surfaces through the force of adhesion.

The adhesion of driving wheels to the rails is the action of a different species of force and relates to friction, which will be treated later.

22. Is there any other species of force which tends to bring substances together?

A.—Yes; there is the operation of chemical affinity which draws certain substances together under favorable conditions. Thus, at high temperatures, carbon has a strong affinity for oxygen and combines with it to form compounds in the act of combustion. There is also magnetism and manifestations of electricity that tend to bring substances together.

23. What is hardness?

A.—Hardness is a property which resists abrasion, cutting or cutting into the particles of its surface. The diamond is the hardest substance known. The hardness of other substances is estimated in relation to the diamond.

Hardness is entirely distinct from density which depends upon the number of molecules in a given bulk. Thus, lead and copper are dense but they are not hard.

24. What is the leading difference between hardness and tenacity?

A.—Hardness resists cutting, tenacity resists any force tending to pull the substance apart. The high tenacity of iron, steel and other metals, known in engineering as tensile strength, renders them suitable for structural and engineering purposes where great strength is required. Steel is the most tenacious material known. John A. Roebling, the celebrated engineer, stated that steel wire had been made that would resist a tensile stress of 300.000 lbs. per square inch. Steel for railway tires has a tensile strength or tenacity of about 65.000 lbs. per square inch. The American Railway Master Mechanics' Association stardard specifications for boiler steel call for a tensile strength of from 55,000 to 65,000 lbs. per square inch.

25. What are the peculiarities known as elasticity?

A.—It is a force closely allied to tenacity and tends to make a substance subjected to outward force recover its shape when the force is withdrawn. When a rail or bridge receives a shock, distortion follows; but the force of elasticity brings bask the member to its original form, unless the shock or stress has been beyond the limit of perfect elasticity in which case the part receives a permanent set.

In the testing of engineering material great attention is bestowed upon its power of elasticity or capacity for returning to its original size after stresses have been applied.

India rubber provides the most striking examples of elastic material which can be easily compressed or stretched within certain limits without damage to the material.

26. What is brittleness?

A.—It is a peculiarity confined mostly to hard substances that makes them break readily from a blow or shock. Glass is the best example of a brittle substance. Brittleness is generally described as being the opposite property to tenacity, but some brittle substances have a high tensile strength, being hard to pull asunder. Cast steel is frequently brittle while possessing very high tensile strength.

27. Describe the property known as ductility?

A.—Ductility is the peculiarity by which certain substances can be kneaded into different shapes. Putty is a good example of a ductile substance, but lead and various metals have the same characteristic to a more limited extent.

28. What is malleability?

A.—Malleability is a form of ductility. Metals possessing this property are easily drawn into fine wire or hammered into very thin plates. Gold is the most malleable of metals, thin gold leaf being a good example of this peculiarity.

In Great Britain a piece of iron that can be welded is called malleable. The common name there for wrought iron is malleable iron.

29. What is the process known as tempering?

A.—The process of tempering is performed principally on steel. By heating the steel to a certain high temperature and cooling it quickly the material is hardened to the degree required. The cutting edge of tool steel is made very hard by this process and steel for springs is tempered to the point which produces the required elasticity.

All the malleable metals can be hardened by hammering and certain kinds of wire are made elastic by straining and rolling under pressure.

30. What is the process known as annealing?

A.—It is a softening process employed to soften glass, porcelain and metals or to take away the unequal strains set up in casting or working the substances.

The usual plan is to subject the articles to a high heat, then permit them to cool slowly.

31. What is case hardening?

A.—It is a process by which the surface of iron is converted into steel while the interior retains the toughness of wrought iron. The usual method is to place the pieces to be acted on into a closed iron box charged with vegetable or, in preference, animal charcoal, and subjecting it to a high heat for hours, the time depending on the depth of steeling required.

A much more expeditious method of case hardening small articles is known as potashing. The article is raised to a bright red heat then covered with pulverized potassium ferrocyanide. After that the piece is again heated and dipped into water.

32. What is torsion?

A.—Torsion is the force applied to twist a rod or other member of a structure. The force to resist torsion is the power which brings back a rod or wire to its original shape after having been twisted.

33. What is known as resistance to flexure?

A.—It is the force with which a solid resists efforts to bend it. In heavily loaded structures or those that have to sustain sudden shocks great care has to be taken to give the supporting beams high resistance to flexure.

The weight that will produce rupture in a beam will vary inversely as the length of the beam. If the beam is doubled in breadth it will resist a force twice as great, if the beam is doubled in depth it will stand four times the weight previously sustained safely.

Calculations for Railway Men.

BY FRED H. COLVIN.

In almost all calculations, even such a simple one as finding the area or square inches in the piston of a locomotive, or the distance around a tire, the use of decimals is such a convenience that it may almost be called a necessity. This is a system which has 10 for a base, and comes from decem, meaning ten. It is not a fundamental principle, but simply a system devised for convenience in calculating.

In this system everything is reduced to tenths, hundredths, thousandths, etc., and the value is determined by the position of the decimal point. Taking the number .375, and we read the first number as tenths, the second as hundredths, the next as thousandths, so that this is "375 thousandths," or 375/1000, the position of the decimal point showing the value of the number.

Moving the point between the 3 and the 7 makes the number 3.75, or three and seventy-five hundredths, while moving it again makes it 37.5. This plainly shows how it varies it by tens, and that we can multiply a number by ten by simply moving the decimal point to the right, and divide by ten by moving it the other way.

Fractions are bothersome to handle in calculations, and the best thing to do in most cases is to change them to decimals. This is done by dividing the numerator or top number by the denominator or bottom number. Taking 3/8 as the number, and dividing 3 by 8, we have a good example to work out. As 8 is larger than 3, we add a few ciphers to the 3, putting a decimal point after the whole number, and this gives us

```
8)3.000(375
  24
  --
   60
   56
   --
    40
    40
    --
```

We forget all about decimal points till after we get through dividing. In this case it comes out even after the third figure, but we rarely go over four places anyhow. Now we count the decimal places to the right of the decimal point in the dividend, and find three ciphers after the 3, so we begin at the right of the quotient (or answer to the division) and count in three places, which puts the decimal point in front of the 3 and makes the number read .375. This shows us that 375 is the same as 3/8.

In order to become thoroughly familiar with this, it is advisable to take several examples, such as finding the decimal equivalent of 1/64, which is .0156, or "one hundred and fifty-six ten-thousandths."

Do not forget that this decimal system is simply a system for convenience, and not a basic principle, for we have time tables which show 7.15 to mean 15 minutes past 7, and have nothing to do with decimals whatever.

Suppose you see it stated that a 20x 26-in. cylinder holds 4.73 cu. ft. of steam every stroke, and that a 20x36 would hold 6.53 cu. ft. You want to know the difference, so we do some subtracting, in this way: Put the figures down, being sure to always place the decimal points under each other. This gives us

```
6.53
4.73
----
1.80
```

as the difference. You can prove this at any time by adding the answer and the lower line of the example together, the same as in simple subtraction. The only thing is to put the points in the right place.

If you want to know what both cylinders together will hold, just add them together the same as whole numbers, keeping the decimal points under each other. This gives

```
 6.53
 4.73
 -----
11.26 cubic ft. for both cylinders.
```

In multiplying we pay no attention to the decimal point until we come to point off the answer; then we count off as many decimal places, from the right, as there are decimal places in both the numbers we are multiplying together. This is largely a matter of care and of common sense. If we multiply 3.6 by 6.4, we get as a result, before pointing off, 2304. As there is one decimal place in each, we know there must be two in the answer; but, even without this, let us look at the whole number. We know that 6 times 3 are 18, and that 6 times 4 are 24; so common sense tells us that the whole number must be less than 24 and more than 18. This tells us that the answer must be 23.04, and that the decimal point cannot possibly belong after the 2, as 2.304, or after the 0, making it 230.4. A little thought along these lines will prevent many a mistake, as it is the easiest thing in the world to put the decimal point in the wrong place if we depend absolutely on counting off, and every figure it is out of the way makes the answer either ten times too large or ten times too small. Get to thinking about what you are doing, and there will be no trouble from this source.

We are now ready to take up a few real examples, which are always more interesting than imaginary ones, and we shall see how the different every-day problems are figured out. By understanding just what has to be done the main difficulties disappear, and you will have no trouble in understanding the work we are taking up.

Suppose we want to find how many times a 76-in. wheel revolves in running a mile. It is perfectly clear that if we know how far it is around the wheel, and then divide the length of a mile by this, we will have the answer.

It was found out years ago by some of the wise old philosophers that the circumference (or outside) of a circle was practically 3 1/7 times the diameter or distance across. This is called a "constant" because it never changes and is the same no matter whether the diameter is in inches, feet or miles; the circumference is 3 1/7 inches, feet or miles around.

The number generally used is, in decimals, 3.1416; although the exact number is carried out to a dozen decimal places, 3.1416 is the one to remember and use.

Multiplying 76 by 3.1416, we have

```
  3.1416
      76
 -------
  185696
 219912
 -------
 2384816
```

and as there are four decimal places in one of the numbers and none in the other, we point off four places from the right, which places it between the first 8 and the 4, and makes the number 238.4816. As the diameter was in inches, this is the number of inches around the tire, or the number of inches it would cover if rolled around once.

There are 5,280 ft. in a mile, and it is either necessary to reduce this to inches by multiplying by 12 or to change the circumference to feet by dividing by 12, and as this is easiest, we do it, and have

```
12)238.4816(198734
   12
   ---
   118
   108
   ---
    104
     96
    ---
      88
      84
     ---
       41
       36
      ---
        56
        48
       ---
         8
```

As there are four decimal places in the dividend and none in the divisor, we point off four from the right and have 19.8734 ft. as the circumference of the driving wheel 76 ins. in diameter. In actual practice we would drop the last two decimals in such a case where extreme accuracy was not required, and we then divide 5280 by 19.87 and get 262.10 as the number of revolutions per mile for a 76-in. driving wheel. In doing this it was necessary for us to put a decimal point after the number 5280 and add four ciphers, making it 5280.0000. Then, as we divided by 19.87, a number only having two decimal places, we point off as many in the answer as the decimals in the number we are dividing exceeds those in the divisor, which were two.

If the engine runs a mile a minute, then the driving wheels are running 262.1 revolutions per minute. If running 30 miles per hour, or a mile in two minutes, then the revolutions per minute are one-half this. But what are the revolutions per minute when running 45 miles an hour? Just divide 262.1 by 60 and multiply the result by 45.

Examples of this kind can best be handled by proportion, which we shall take up next.

GENERAL Questions Answered

(107) J. T., Akron, Ohio, writes:

Why is it that some locomotives get hotter in front ends than others? A.—Because the smoke box door or front joint is not air tight, the admission of air causing combustion in the smoke box, the fire being fed by the small pieces of unburned coal and cinders. Sometimes the leak occurs in the base of the smoke stack, which should be carefully fitted and cemented. The joints should be examined and kept tight, as they are very difficult to repair when bent or warped.

(108) L. M. B., Laramie, Wyo., writes:

We had a locomotive in the roundhouse that started itself and came near running into the pit. The throttle was shut and there was a good deal of talk about how it could happen. How do you think it moved? A.—There is nearly always more or less leakage in the throttle valve, and if the cylinder cocks are not left open the boiler pressure will eventually reach the cylinders and move the pistons. The reverse lever should always be left in the center, in which position the valves will not open sufficiently to admit enough steam to move the engine.

(109) J. M. L., Terre Haute, Ind., writes:

Would be glad if you can furnish me the name of a road, or roads, that are now using the Duplex Pressure Control. Would also be glad to have your opinion of its use. We would like to, if practicable, reduce the storage capacity from 64,000 cubic inches to 45,000 cubic inches in order to relocate the pump, which now obstructs the view of the fireman. Would this, with the Duplex Pressure Control, serve as well? A.—Space will hardly permit our giving you a full list of names of roads using the Duplex Pressure Control, but you may take it for granted that nearly all level roads, where long trains are hauled, are using it; also roads having steep grades, where it is very essential to be able to recharge auxiliaries quickly after each release. We agree with you that it is desirable to so place the pump that it shall not obstruct the view of either the engineer or the fireman; but if it is necessary to reduce the main reservoir volume to accomplish this important object, we should say by all means use the Duplex Pressure Control. While we do not like to see main reservoir volume reduced, yet where it is absolutely necessary to do so, the Duplex Pressure Control will make up largely for the loss of volume.

(110) L. F., Melrose, Minn., writes:

Please advise what effect on a one car train with a new quick action triple valve, an air pump governor with defective packing ring, for example, in testing triple on coach, will have. I made 5, 10 and 15 lbs. reductions, and sometimes brakes set on this coach and sometimes did not. I had a governor on engine that blew through packing ring very bad. When this was blowing pump would work when I made the reduction, as it appeared, on the coach. The brake on this coach would not always set. I shut off pump, and the blow through the governor then stopped. I could then make a 5 or 18 lb. reduction and the brakes would operate every time. Am I right that the cause the brakes not setting was on account of defective packing ring in governor? Will say this governor and pipe is attached in train line with D-8 Westinghouse engineer's brake valve. A.—No effect whatever. A defective packing ring in the pump governor piston, that allows air to leak past it freely, will cause the governor to lose control of the pump, and the latter will then pump air into the main reservoir, after the pressure therein reaches the maximum for which the governor is set. When the brake is applied (with a D-8 brake valve and single governor pipes, as you state), the speed of the pump will increase, whether the packing ring leaks or not.

We are of the opinion, assuming that the rotary valve was tight, that the failure of the brake to apply, in some instances, after you had made service reductions was on account of an overcharged brake pipe. This could easily be the fact in your case, since you had a short brake pipe, with the probability of high excess pressure, as the pump was practically uncontrolled.

When you shut off the pump, the main reservoir pressure reduced so that the likelihood of an overcharged brake pipe was less, and with subsequent reductions your brake applied each time.

(111) P. D. M., Queensland, writes:

Where does the Walschaert valve motion, as applied to locomotives, obtain its lead? A.—It will be observed that the eccentric crank is adjusted at right angles to the main crank pin. This gives the valve half a stroke in advance of the piston stroke; in other words, when the piston is at the end of the stroke the valve will have traveled exactly half the distance of its stroke in the direction which would be followed by the piston. As half the stroke would not be exactly in the right position the variation is made up by the combination lever and short rod connecting the valve crosshead with the main crosshead. These rods in conjunction with the valve rod, which is attached to the valve rod crosshead by adjustable nuts, are adjusted so that the valve is made to open at the desired point, and which opening it will retain at any length of valve stroke. See illustration and description in October issue, page 439.

What is considered in America the best metal for main axle boxes for engines. A.—Cast iron.

ACCELERATION FORMULA.

(112) H. C., St. Paulo, Brazil, writes:

On page 15, of Baldwin's small book, Locomotive Data, I find the following formula for the value of train resistance due to acceleration per ton of train weight: $A = 0.0132 (V'^2 - V^2)$, where V and V′ are respectively the initial and the accelerated speed. Will you please explain what this means, and how the factor 0.0132 has been obtained. A.—The resistance in pounds per ton (2,000 lbs.) = .0132 ($V'^2 - V^2$) means that if we are running a train with a constant speed of V miles per hour and wish to increase this speed in a distance of one mile so that the train will run at V′ miles per hour, it will take .0132 ($V'^2 - V^2$) pounds per ton of train (including the locomotive and tender) to obtain this speed, and this force must be furnished by the locomotive.

As an example, suppose we have a train whose total weight (including engine and tender) is 600 tons, and which passes mile post 112 at a rate of 20 miles per hour. Now, if we want to be running at 30 miles an hour when mile post 113 is passed, the extra force needed by the locomotive will be .0132 ($V'^2 - V^2$) = .0132 ($30^2 - 20^2$), that is, we square the speed desired, $30 \times 30 = 900$, and also the present speed, $20 \times 20 = 400$, and subtract $\begin{array}{r}900\\ 400\\ \hline 500\end{array}$ and then multiply by .0132, thus: $\begin{array}{r}.0132\\ 500\\ \hline 6.6000\end{array}$ or 6.6 lbs. per ton of train; and, as train weighs 600 tons, $\begin{array}{r}6.6\\ 600\\ \hline 3960.0\end{array}$ or 3,960 lbs. must be exerted by the pull of the engine (at circumference of drivers) over and above that necessary to overcome the friction of the train, in order to obtain the desired speed at the next mile post.

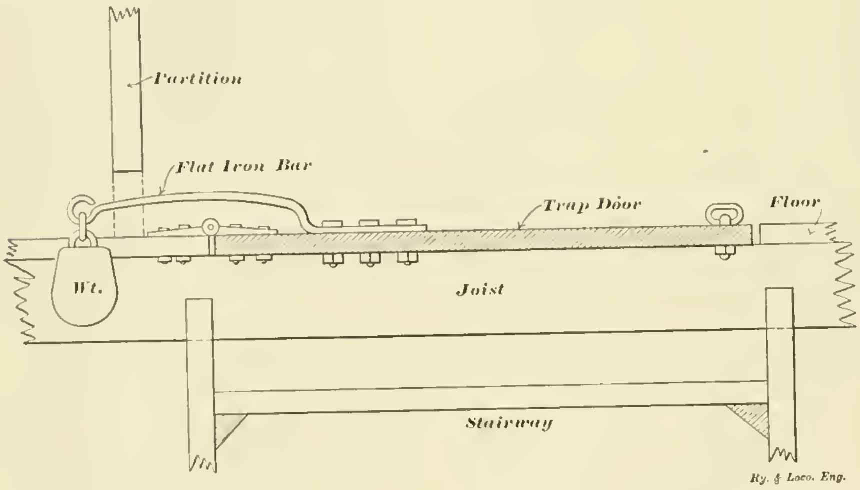
If the train is standing, V = l.f., and we have resistance = .0132 V'^2, or .0132 $\times 30^2$, which is $30 \times 30 = 900$, and $\begin{array}{r}.0132\\ 900\\ \hline 11.8800\end{array}$ or 11.88 lbs. per ton, so that $\begin{array}{r}11.88\\ 600\\ \hline 7128.00\end{array}$ that is, 7,128 lbs., pull will be needed to start a train from rest and attain a speed of 30 miles an hour in a distance of one mile, when the total weight is 600 tons, and this is in addition to the speed resistance, grade, curvature, or any other causes except the increase of speed.

This can be found from the diagram without calculation, thus: Notice where curve intersects the 30 miles of accelerated speed at bottom; we find this to be nearly 12 lbs. per ton on side scale (our calculations gave 11.88). At 20 miles an hour it is about 5¼ lbs., and by subtracting $\begin{array}{r}12\\ 5\frac{1}{4}\\ \hline 6\frac{3}{4}\end{array}$ lbs. per ton needed, our calculations gave 6.6, quite close.

Oil Tanks and Trap Door.

If you should happen in at the Canadian Pacific Railway stores department offices at Moose Jaw, Sask., you would be able to see some good concrete oil tanks in the basement of the building. They are about 3 ft. high, 4 ft. wide and 12 ft. long, and are lined with zinc plate. They vary in width according to the character and quantity of oil to be stored. The walls of the tanks are about 8 or 10 ins. thick. A float indicator shows the height of oil in each tank. Oil is drawn upstairs by means of an ordinary pump and the drip flows back to the tank in the usual way. The line of pumps are placed close together above and so economize space, while the tanks below occupy a much greater area. Oil barrels are rolled in on top of the tanks and are easily emptied and rolled out again without interfering with anything. The tanks are convenient of access, although out of the way as far as the stores department is concerned. They are fireproof in construction and being in the basement are naturally protected from the danger of fire.

There is a rather good balanced trap-door at the entrance to the basement stairway. The door is in the floor near a partition as shown in our illustration and its edges lie upon the two joists which form the boundaries of the stairway. To the upper side of the trap-door is bolted a flat iron bar having a slight off-set in it. The flat iron bar passes under the partition through an opening cut for the purpose and at the end of the bar is hung a weight which about balances the door. The weight is so proportioned that when the door is shut down, it stays down, though very little effort is required to raise it up. When the door is up, the weight is in its lowest position and keeps the door up against the partition wall. There is a certain amount of spring to the flat iron bar which prevents shock when the door is raised or lowered, and the door always stays where it is put, either up or down. A modification of this arrangement could be made by having the weight with a slot in it through which the flat bar could pass and be secured at any distance from the hinge by a set screw. The plan shown here, where the distance is fixed, necessitates the adjustment of the avoirdupois of the counterweight itself, but it is handy and serviceable either way.



BALANCED TRAP DOOR AT MOOSE JAW ROUND HOUSE.

Blowing Up a Wreck.

The wreck of the British steamer Chatham, with her cargo of 90 tons of dynamite and blasting gelatin, that lay blocking the passage of the Suez Canal, was blown up last month by mines around and inside the hull. These were fired by an electric current at a distance of five miles. The explosion was tremendous. A huge column of water, sand and ship's wreckage was thrown half a mile into the air, and about 600 ft of the east bank of the canal was destroyed. The adjoining railway was untouched.

A peculiarity of American railroads is the readiness with which the more enterprising companies are to scrap freight cars that appear to be still in serviceable condition. We have learned that in following this policy, the Pennsylvania Railroad Company are about to scrap 12,000 freight cars. These will be replaced by cars made of pressed steel and of the most advanced types in perfection of equipment. No doubt this great railroad which has been in many ways the most progressive in the world, would not have ventured on such wholesale renovation had not the promise of present and future transportation interests been so stimulating. It is most encouraging that prescience and sagacity in such high quarters point to a cloudless business horizon. Nor have there been lacking eloquent indications on the part of our other big railroads of a similar lavish, yet really economical policy toward perfecting equipment, both of fixed plant and rolling stock.

Air Brake Department.

CONDUCTED BY J. P. KELLY.

A New Editor.

Commencing with this issue of Railway and Locomotive Engineering, Mr. J. P. Kelly will have charge of the Air Brake Department, succeeding Mr. F. M. Nellis, who has so long and successfully conducted this department. Mr. Kelly began his career as a news boy and water boy on the passenger trains of the Housatonic Railroad, now the Berkshire division of the New York, New Haven & Hartford. Then he became a fireman on the same road, afterward being promoted to the position of engineer. Mr. Kelly is a natural student, with predilections mechanical. From the first day he was connected with the locomotive he was earnestly making himself master of all train mechanism. For about a year he was air brake instructor and road foreman of engines of the Chicago & Alton Railroad. With an experience of 15 years as fireman and engineer, he went to the New York Air Brake Company as expert and remained with that company till a couple of months ago. According to our judgment, Mr. Kelly will make a worthy successor to Mr. Nellis.

Group of Westinghouse Air Brake Experts.

1 Whitney, Frank H.; 2. Hutchins, S. D.; 3. Kolseth, Henry S.; 4. Farmer, Fred.; 5. Olmstead, C. J.; 6. Clark, Horace S.; 7. Reese, F. T.; 8. Miller, John F.; 9. Brown, A. B.; 10. Godard, Luis; 11. Ransom, W. G.; 12. Domville, Mr.; 13. Purtill, L. F.; 14. Newburn, T. W.; 15. Townsend, C. W.; 16. Dawson, E. H.; 17. Turner, W. V.; 18. Craig, E. A.; 19. Humphrey, A. L.; 20. Ellicott, Joseph R.; 21. Tregelles, Henry; 22. Clark, W. G.; 23. Burgess, Robert; 24. Cass, C. P.; 25. Badders, James; 26. Adreon, E. L.; 27. Bartholomew, W. S.; 28. Johnson, A.; 29. Blackall, R. H.; 30. Crocker, H. A.; 31. Siegrist, James S.; 32. Adreon, R. E.; 33. Cameron, A.; 34. Johnson, F. B.; 35. Hedendahl, T. A.; 36. Brown, I. H.; 37. Parke, F. H.; 38. Farmer, C. C.; 39. Donovan, P.; 40. Guilfoyle, F. G.; 41. Ames, J. F.; 42. Sprague, Willis; 43. Down, S. G.; 44. Kidder, S. J.; 45. Burton, T. L.; 46. Martin, G. H.; 47. Nellis, F. M.; 48. Newell, E. W.; 49. Williams, R. W.; 50. Baker, George.

GROUP OF WESTINGHOUSE AIR BRAKE EXPERTS.

Main Reservoir Capacity.

It is generally understood by air brake men that the capacity of the main reservoir with which the locomotive is equipped, should bear a certain fixed relation to the number of cars which the locomotive can haul. It is clear that this should be so, since the proportion of brake pipe and auxiliary volume varies directly as the length of the train, and because it is desirable that the brake pipe and the auxiliaries be charged to the standard pressure as quickly as possible after each brake release.

If none but service applications were made, using brake pipe pressure reductions no heavier than is required to equalize the auxiliary and the brake cylinder, the required capacity of the main reservoir might, in many cases, be considerably less than what is usually provided on many of the modern heavy locomotives, and results in practice be quite satisfactory. But it occasionally happens that a hose bursts, the train parts, or an emergency application is required under which conditions the brake pipe is entirely depleted. It is under these circumstances that the large capacity reservoir performs a most important service, as, after the bursted hose has been replaced, the train recoupled, or the emergency has passed, whichever it may be, the brake pipe may be almost instantly recharged to a pressure sufficiently high to release all brakes promptly, and thus allow the train to proceed quickly. Time being the most important element in successful railroading, the capacity of the main reservoir, as a factor in economizing in the use of it becomes of great importance.

Aside from the consideration of time saving, main reservoir capacity as a safety factor in the expeditious and satisfactory handling of heavy trains down long steep grades is of the utmost importance.

The above considerations with respect to the main reservoir capaciay should not be lost sight of when the air brake equipment is specified for the locomotive.

The New Westinghouse Feed Valve.

The accompanying illustrations of this device given herewith will explain the operation of this accurate and thoroughly reliable piece of mechanism, which is so generally coming into use on steam railroads, where a reliable feed valve is required, as well as in electric traction service. These two cuts are purely diagramatical, and are employed merely to give an understanding of the workings of the inner parts of the valve, attachment brackets and other parts being intentionally omitted.

Main reservoir pressure enters at port *a*, passing through port *d* in the slide valve to port *e*, branching off into port *f*, where it finally reaches the left side of the diaphragm of the adjusting attachment. Passing from port *e*, the pressure enters the train pipe, thus giving the same pressure in the line and on the left side of the diaphragm.

The pressure in chamber *B* will pass through pin-hole *h* in the piston to chamber *C*, thence through port *g* to the small escape valve 20, which is held to its seat by the light spring 21.

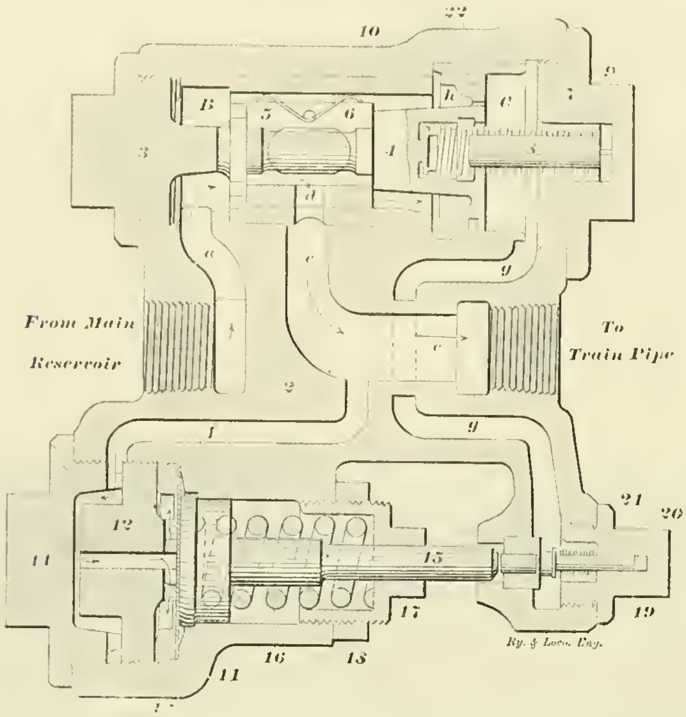


FIG. 1. NEW WESTINGHOUSE FEED VALVE. OPEN POSITION.

When pressure in the line and on the pressure side of the diaphragm are sufficiently great to overcome the tension of spring 16, piston 15 will be forced to the right engaging and unseating escape valve 20, thus permitting the accumulated pressure in port *g* and chamber *C* to escape. This escape of pressure empties chamber *C*, and the pressure in chamber *B*, on the opposite side of the piston, will force the piston and slide valve to the extreme right, cutting off communication between the main reservoir and port *e*, which supplies the line and the diaphragm chamber.

Fig. 2 shows the operative parts in the closed or inoperative positions. When, through leakage or use of pressure in the line, the pressure is reduced in ports *e* and *f* lower than the resistance of the regulating spring 16, piston 15 will move to the left, allowing escape valve 20 to seat, and the feed of pressure from chamber *B*, through pinhole *h* into chamber *C* until the pressure of both side of the piston become equalized, when spring 9 will force the piston and slide valve to the left, again opening up the main reservoir supply into the line.

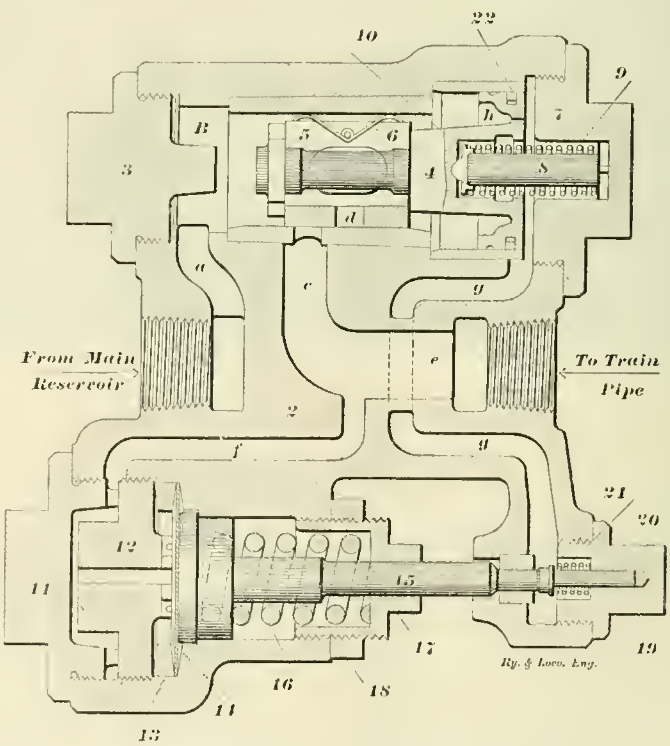


FIG. 2. NEW WESTINGHOUSE FEED VALVE. CLOSED POSITION.

Frozen Brake Pipes.

We are now approaching a season of the year when the danger from frozen brake pipes must be guarded against, and to do this intelligently, the design and the number of main reservoirs, together with the method of piping them, must be given careful attention. Fortunately, however, we have the results of the investigations of a committee, appointed by the Air Brake Association, to determine the causes of the presence of moisture in the brake pipes, and hence the consequent freezing in extreme cold weather, or during the more moderate weather immediately following a cold snap, and we are enabled by following the recommendation of this committee to rid the brake pipe of the objectionable elements.

It should be borne in mind that at all seasons of the year, and under all conditions of temperatures and pressure, the atmosphere contains some moisture held in suspension; so that an air pump is always drawing this moisture into the air brake system along with the air that it is compressing.

The capacity of air for holding moisture in suspension depends upon its temperature and pressure. If we increase the temperature of air, the pressure remaining constant, its capacity for holding moisture will be increased, or if air is compressed to a higher pressure, its temperature remaining constant, its capacity for holding moisture will be decreased.

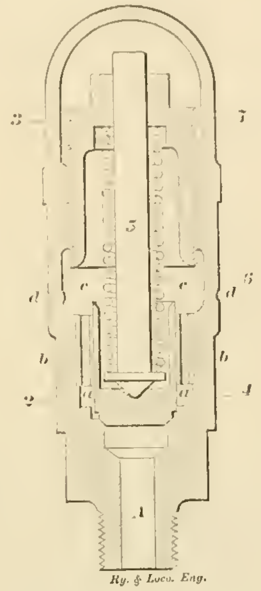
The committee above referred to, determined that if the air in the main reservoir could be cooled down to the same temperature as that of the surrounding atmosphere before it was allowed to pass back into the brake pipe, it would not deposit, or give up, any moisture; hence, the brake pipes would receive "dry" air only.

To effect the cooling of air to the desired temperatures, they found, first, that a discharge pipe varying in length between fifteen and twenty-five feet, was necessary between the air cylinder of the pump and the first main reservoir; second, that the form of the main reservoir should preferably be long and slim, since reservoirs of this design possess better heat radiating qualities than those of the short and thick variety; third, that the use of two main reservoirs, connected by an equalizing pipe, was preferable to the use of one, as the first reservoir could be used to catch the greater portion of the dirt, oil and precipitated moisture, and the second to furnish the air cool and "dry" to the brake valve and brake pipe.

They further recommended that, if possible, the discharge pipe have an incline downward from the pump to the main reservoir, so that in extreme cold weather any moisture that might be deposited in this pipe could flow by gravity to the main reservoir; that the equalizing pipe be without pockets and depressions for the collection of moisture. On many engines nowadays this equalizing pipe passes from one main reservoir, on one side of the engine, over the top of the boiler to the other main reservoir on the other side. Another important matter in connection with the piping, touched upon in the report, was the importance of having all connections made about midway in the ends of the reservoirs, those carrying air into the reservoir being made at one end; those taking air out of the reservoir at the other.

These recommendations represent the ideal conditions, which should be approached as closely as possible in practice, for the prevention of the deposit of moisture in the brake pipe.

But however good the piping and other conditions surrounding the main reservoirs, they should, nevertheless, be frequently drained, especially during the late fall and the whole of the winter months of all accumulated moisture.



NEW SAFETY VALVE.

Improved Safety Valve.

The illustration shows the improved Westinghouse ½-inch safety valve, which, as will be seen, is considerably different from the older type.

The escape valve, 4, is held to its seat by stem 5 and spring 6. The adjusting nut, 7, determines the pressure held by the valve.

It should be observed that when the escape valve 4 is slightly off its seat the discharge of air will pass upward through the restricted passageway between seat of the valve and the wall of the casing, into chamber *a*, through restricted port *b* into chamber *c*, thence escaping through ports *d* to the atmosphere.

There are 6 of these restricted passageways *b*, and a like number of escape ports *d*. Should the valve be required to blow off a large volume of pressure, valve 4 will lift higher off its seat, removing the restricted passageway, and free vent of the escaping pressure will be given through ports *a*, *b* and cavity *c* and ports *d* to the atmosphere.

Thus it will be seen that the valve can handle equally well a large volume of escaping air as a small volume. With a small volume of air, valve 4 will rise, blow off pressure gradually, then reseat. In a heavy venting of escaping pressure, the valve 4 will rise higher, and a continuous escaping of larger volume will be had.

The maximum escaping volume of pressure which will pass through the large port *a*, will easily pass through the 6 smaller ports *b* and *d*. The valve is positive in its action, as will be seen.

Cleaning and Testing Triple Valves.

Editor:

I have charge of the triple valve repair room at the Louisville & Nashville R. R. shops here. We test every triple after it has been cleaned through a 1/32 in. hole, which is drilled through the cut-out cock under the brake valve. We use boys to clean triples.

I have one 8 in. Westinghouse pump with the air end bushed down to 5 ins. The pump furnishes plenty of air for our test rack; with 50 to 75 lbs. of steam the air goes up to 85 and 100 lbs. I have two main drums, one at the pump and the other in the triple room; I want to send you a sketch of our rack as soon as I can get it up for you. We work the triple upside down while cleaning it, so by this we place the feed groove so it can be seen. We have holding racks or clamps to hold the triple in this position while it is being cleaned. While the triple is receiving its cleaning, we have some men in the shop yard cleaning cylinders, and after the triple is replaced, the car is tested in the yard by the yard test men, who look after piston travel and train pipe leaks, etc. You see, we have a double check on the triples, as they are tested in the room and after they are placed on the car. We make an average of 750 to 900 a month.

W. W. HAYDEN.

Birmingham, Ala.

Improved Double Check Valve.

The accompanying illustration shows the double check valve manufactured by The Westinghouse Air Brake Co.

The illustration is purely diagramatic. intended only to convey an understanding of the operation of the parts, and therefore does not show the bracket connections by which the valve can be fastened and supported.

There are three pipe connections to the valve, viz.: from straight air brake valve, from the triple valve, and to brake cylinders, as designated.

The usual spool valve, 16, operates in its cylinder, from which are ports *c* and *d* to the brake cylinder.

In addition to the spool valve, will be seen the automatic air piston, 12, and straight air piston, 13, operating in the lower part of the valve casing.

In the automatic application of the brakes, the air from the triple valve passes through chamber *X*, port *a*, and chamber *b*, forcing the spool valve 16 to the left, thus opening a passageway to the brake cylinder through ports *c*, in the usual well known manner.

At the same time, the air passes to chamber *m*, forcing valve 12 to the left, and leather seat 12*A* against its seat 12*B*, thus closing the outlet through ports *f*, *g* and *h* to the atmosphere.

In releasing the brake, the pressure in the brake cylinder will return through ports *k*, *c*, chamber *b*, and port *a* to the triple valve, where it is discharged in the usual manner.

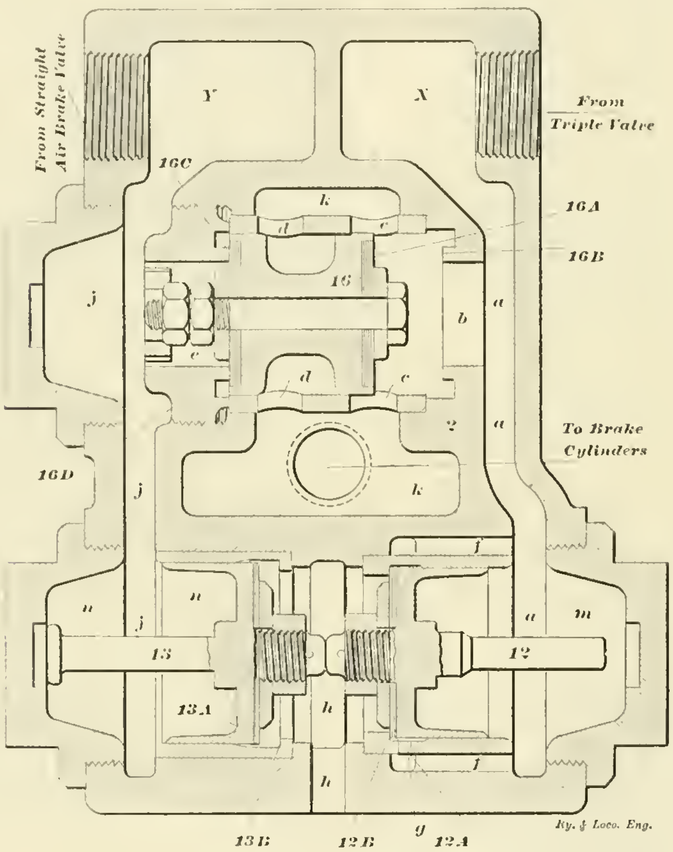
In a straight air application of the brake, air enters at chamber *Y*, passes downward through port *J*, chamber *e*, forcing the spool valve to the right and leather seat 16*A* against metal seat 16*B*, thus closing connection from the triple valve to the brake cylinder, and opening connection for the straight air through ports *d* and chamber *k* in the usual well known manner.

At the same time the straight air pressure extends to the left side of valve 13 in chamber *n*, forcing the valve to the right, its leather seat 13*A* against the metal seat 13*B*, and forcing valve 12 to the right, breaking the joint between leather seat 12*A* and metal seat 12*B*.

To release pressure from the brake cylinder it passes through chamber *k*, ports *d*, chamber *e*, port *j* and chamber *Y* to the straight air brake valve. When valve 13 is seated and valve 12 unseated, any leakage of pressure coming from the triple valve is permitted to escape through ports *f*, *g* and *h* to the atmosphere.

If the straight air brake is applied, it will be impossible to put auxiliary reservoir pressure in on top of it, except in emergency application, as a service application will pass out through ports *f*, *g* and *h*.

As will be noted, the straight air valve 13 is larger in diameter than the automatic valve 12. This is because the maximum brake cylinder pressure in straight air application, due to the adjustment of the feed valve, will give 53 pounds maximum brake cylinder pressure. The smaller diameter of the valve 12 will require nearly 60 pounds to seat it against the opposing pressure of valve 13.



NEW WESTINGHOUSE DOUBLE SEATED CHECK VALVE.

Large Order.

The Pennsylvania Railroad has given an order for 17,000 freight cars. This seems a simple statement, but it is interesting when analyzed. These cars would make a train nearly 150 miles long, and if strung along the track would about reach from Philadelphia to Mifflintown. All together, they could carry about 700,000 tons of freight. On a single trip of 200 miles, at the lowest rate of compensation, such a train would earn over $350,000.

Preferred L. E. to Cigars.

As Christmas approaches many people are puzzled to know what will be an acceptable Christmas present. An engineer on one of our leading lines says in a letter ordering some books: "Last Christmas morning I found on my breakfast plate the receipt for a year's subscription to LOCOMOTIVE ENGINEERING, which my wife had put there. I thought it was a silly Christmas present, and was disgusted that it was not a box of cigars. I am feeling different now, and welcome something better than a smoke about the second week of every month. Say, why can't you hurry up your blamed paper?"

Freight Cars Ordered by Pennsylvania Railroad Company, October, 1905.

	Lines East.	Lines West.	Total.
Pressed Steel Car Co.:			
Class GLa., all steel self-clearing hopper gondola........		2,500	
Class Gsd., all steel gondola with drop bottom	5,500		
Class XL., box car.. (1,000 to be built at Works of Western Steel Car & Foundry Co.)	4,000		
Total	9,500	2,500	12,000
American Car & Foundry Co.:			
Class GLa............		2,500	
Class XL.............	600		
Total			3,100
Standard Steel Car Co.:			
Class Gsd............	2,000		2,000
Cambria Steel Co.:			
Class Gsd............	2,500		2,500
Middletown Car Wks.:			
Class XL.............	400		400
Grand total....	15,000	5,000	20,000

Totals by classes:

Gsd.	10,000
GLa.	5,000
XL	5,000
	20,000

These cars are all of 100,000 pounds marked capacity—the box cars having steel underframes, and American Railway Association standard inside dimensions.

Deliveries begin in March, 1906.

Seventy-five coaches, seventy feet in length, equipped with reclining chairs, upholstered in green, are being added to the Harriman lines west of Ogden. 136 locomotives and 5,200 freight cars of various kinds are in course of construction and will be ready early next year.

The Panama Canal Commission has placed an order for 120 locomotives from the American Locomotive Company. One hundred of them will be used for yard purposes and the rest for heavy service. Work is already begun on the order in the Allegheny shops.

Baldwin Balanced Compound for the C. R. I. & P.

Our illustration shows the general appearance of the first balanced compound 4-4-2 engine built by the Baldwin Locomotive Works for the Chicago, Rock Island & Pacfic Railway. The fact that it is a balanced engine is apparent from the arrangement of the counterweights on the driving wheels. The cylinders are 15 and 25 ins. by 26 in. stroke. the driving wheels are 73 ins. in diameter.

The cylinder and valve arrangement is compact, being all placed under the smoke arch in the usual way. The high pressure pistons drive on the leading axle, which is cranked and the low pressure cylinders are outside with valve chamber above and between both. The

4-4-2 FOR THE CHICAGO, ROCK ISLAND & PACIFIC.

T. S. Lloyd, General Superintendent of Motive Power. Baldwin Locomotive Works, Builders

low pressure piston rods are quite long, as may be seen in the half-tone illustration, for, although the crosshead on the right side is near the end of the guide bars the crank is on the bottom quarter, only a certain portion of the piston rod enters the cylinder at each stroke. The main valves of this engine are of the balanced piston type and are actuated by indirect motion, the eccentrics being carried on the trailing axle. The driving journals are 10x10½ ins. for the leading pair and 9x12 ins. for the back pair. The carrying wheels at the back are 45 ins. in diameter and their axle has 8x14 in. outside journals.

The boiler is one known as the extension wagon top type, the smoke box end being 66 ins. in diameter. The staying is radial and the pressure carried is 220 lbs. The fire box is 107 9/16 ins. long and 67¼ ins. wide, with depth varying from 78½ ins. at the front to 66 ins. at the back, and giving a grate area of a little over 50 sq. ft. A 4½ in. water space surrounds the box on all sides. The tubes are 273 in number, each 18 ft. 10 ins. long which gives a heating surface of 3,015 sq. ft. The fire box heating surface is 194 sq. ft., making in all 3,209 sq. ft.

The tender is the ordinary U-shaped style with water capacity of 7,000 U. S. gallons and a fuel load of 12 tons. The tender frame is of steel channels and the whole is carried upon two arch bar trucks having steel tired wheels the same diameter as the engine truck wheels, viz., 33½ ins. Some of the leading dimensions of this interesting engine are as follows:

Boiler—Thickness of sheets, 11/16 in. and 13/16 in.; fuel, soft coal.

Fire Box—Thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, 9/16 in.

Wheel Base—Driving, 6 ft. 10 ins.; rigid, 16 ft. 2 ins.; total engine, 30 ft. 3 ins.

Weight—On driving wheels, 105,540 lbs.; on truck, front, 51,780 lbs.; on truck, back, 42,080 lbs.; total engine, 199,400 lbs.; total engine and tender, 340,000 lbs.

Baldwin's Gasoline Truck.

The success achieved by the Union Pacific Railroad with the gasoline motor for light passenger traffic and other successes of a similar character, have stimulated the Baldwin Locomotive Works to design a gasoline power truck that can be applied with little work to any passenger car.

Talking on the subject of this truck, Mr. Converse is reported to have said:

"So far the work has progressed most satisfactorily. Its scope of usefulness will depend more or less upon the successful results we hope to attain. The successful use of gasoline in automobiles first suggested to us the idea of the propulsion of passenger cars on railroads by the same means. The truck will be so constructed that it can be placed under the ordinary passenger car and operated over the rails used by steam locomotives. The advantage of this is obvious. In the first place, the cost of equipping cars will be comparatively small. Consequently, railroads can provide for an extensive suburban service at small additional expense. On small roads, where a locomotive is now used to haul one or two coaches, the gasoline truck will be of sufficient power to handle that tonnage at far less cost."

Favors Holding On to Established Privileges.

The Annual Convention of the Street Railway Association, held in Philadelphia last month, was a notable gathering on acount of the action it took to carry on a systematic fight against municipal ownership of street railways.

President Ely, in his inaugural address, denounces municipal ownership as socialism and declares it to be a theory pure and simple without the slightest possibility of practical demonstration. In the next breath he announced that the reorganization of the Association, together with all kindred associations, was simply to provide the necessary money for a concentrated fight against municipal ownership. President Ely was speaking to a body of men representative of the management, and in many instances the ownership, of practically every street railway corporation in the United States.

The technical papers and discussions were unusualy valuable and shows the American Street Railway Association and the affiliated organizations to be composed of most enterprising and progressive men. The most important work done, however, was a reorganization made for the purpose of fighting the fiends in human shape who are advocating the municipal ownership of public utilities.

We do not think there is much danger of the development of public sentiment that would lead to municipalities taking control of street railways, but if such a thing should come about the street railway companies will have themselves to blame. We have no idea of how the Street Railway Association intends to spend the money that will be raised to fight that form of socialism which calls for municipal control of all public utilities, but if the crusade is to be carried in academic fashion, to educate the public into sound political sentiment, the efforts are likely to be wasted.

In Great Britain, where a considerable mileage of street railways have come under municipal control, the change was invariably brought about by costly and unsatisfactory service rendered by the companies whose franchises were taken away. If street railroad companies in the United States render inferior service at high charges while collecting the money necessary to pay inflated dividends, it will take very energetic educational inspiration to keep down the growing sentiment in favor of municipal ownership of all public utilities, including street railways.

We have recently read expressions of prominent capitalists to the effect that the tendency towards municipal ownership is a fad that will soon pass away. People with great property interests at stake, who can express themselves in that way, are to be congratulated on their optimistic views, but we fear they are based more on hope than on faith. The trend of sentiment, materialized by ballots, is in favor of taking away from the capitalist class all the privileges that have been abused.

Boiler Plate Lifters.

Some time ago we published a sketch of a boiler plate lifter. That is a device which was hung from the end of a shop crane hook and was intended to catch hold of the plate in such a way that it could not slip when the crane was lifting it and carrying it in the shop. Here are two sketches of plate lifters which are used on a large railway system. Fig. 1 is to be found in the boiler shop of the Canadian Pacific Railway at Vancouver, B. C., and is a home-made affair, fashioned out of boiler plate. This lifter is so arranged that the weight of the plate helps to lock the holder and slipping is impossible with any plate so held. This holder is useful in carrying a plate from place to place in the shop, the plate being maintained in a horizontal position. Two of them are necessary to lift a plate. Fig. 2 used on the same road at Winnipeg, Man., has a different function to perform, and is intended to pick up a plate standing vertically in a rack and pull it out from among others. This lifter does not take up much space and the plates in the rack do not need to be moved very much in order to let it drop in over the plate to be lifted. A flat spanner can be slipped over the head of the set screw and the latter when tightened up holds the plate firmly when it is lifted out of the rack. Fig. 1 is an example of a very easily made and thoroughly safe lifter for carrying a plate through a shop. Fig. 2 is an example of a device used for the special purpose of pulling a plate out from among a number of others as one would draw a card from the center of a pack. Each has its proper use and each does the work it is designed to accomplish.

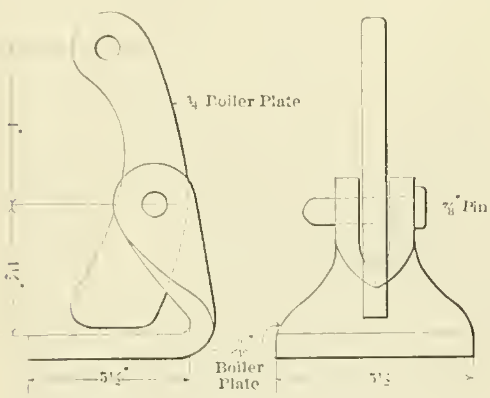


Fig. 1

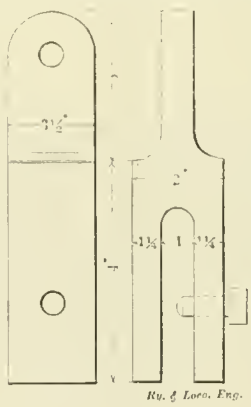


Fig. 2

TWO STYLES OF BOILER PLATE LIFTERS

Advance in Boiler Maintenance.

Among the many pamphlets and publications which came into our office last month there was one which could not fail to attract attention. It was entitled "A Marked Advance in Locomotive Boiler Maintenance," and is being sent to those interested in the subject by the Railroad Department of the Kennicott Water Softener Company, of Chicago. The substance of this pamphlet is by Mr. A. R. Raymer. assistant chief engineer of the Pittsburgh & Lake Erie Railroad. This gentleman speaks with authority on the subject as he has been closely connected with the installation and maintenance of the water softening plant on that road. Comparing results in August of 1902 with results in August, 1904, it is stated that during the former period raw water was used, and during the latter treated water only was supplied to engines. In August, 1902, leaky boilers caused twenty-seven trains to be given up, while the number given up in August, 1904, was only two. The number of engines which had to reduce loads by setting out cars on account of leaky boilers was, for the first period, thirteen, while during the latter period no such reduction of load was needed for any engine. The number of through trains with delays of one hour and over with engines changed at McKees Rocks on account of leaky boilers was thirty-one, while for the similar period of 1904 there were only three such delays.

The whole pamphlet is interesting and gives in detail the P. & L. E. method of boiler washing, together with other information bearing on the whole question. The Kennicott people will be pleased to send a copy of the pamphlet to anyone who is interested in this very important subject. It is altogether a very useful compendium of what has been, and what may be done in this direction on roads where conditions are intelligently studied. The printing and general get up of the publication is exceedingly good and it conforms to the M. C. B. standard for catalogue sizes.

They Like Steel Cars.

The employees in the Railway Mail Department have expressed great satisfaction at the action of the Erie Railway Company in providing new mail cars that will afford a measurable degree of safety and comfort to the mail clerks. The marked improvement is warmly commended to the attention of other railway companies.

Of Personal Interest.

Mr. Marsden J. Perry has been elected president of the Norfolk & Southern, with headquarters at New York.

Mr. Charles W. Allen, general foreman of motive power of the Reading division of the Philadelphia & Reading, has been given charge of all round houses on the Reading and Lebanon division, his territory being thus extended. Mr. Allen's headquarters will be at Reading, Pa.

Mr. John Roche, formerly of the Baldwin Locomotive Works, has been appointed foreman of the blacksmith department in the locomotive shops of the Philadelphia & Reading, at Reading, Pa.

Mr. W. M. Smith has been appointed roundhouse foreman of the Philadelphia & Reading, with headquarters at Cressona, Pa.

Mr. G. H. Carter has been appointed foreman of shops of the Philadelphia & Reading, with headquarters at Philadelphia, Pa.

Mr. A. McCormick has been appointed master mechanic of the St. Louis, Iron Mountain & Southern, in charge of the Valley and Arkansas divisions south of Little Rock, with headquarters at Barin Cross, Ark.

Mr. James Ogilvie has been appointed master mechanic of the Ottawa division of the Grand Trunk, with headquarters at Ottawa, Ont.

Mr. J. G. Lorton has been appointed division superintendent of the St. Louis, Iron Mountain & Southern, with headquarters at McGehee, Ark.

Mr. W. G. Edmondson, formerly connected with the Pennsylvania shops at Altoona, Pa., has been appointed to the newly created position of engineer of tests of the motive power department of the Philadelphia & Reading, with headquarters at Reading, Pa.

Mr. C. V. Coe has been appointed assistant superintendent of the Wheeling & Lake Erie, with headquarters at Rook, Pa.

Mr. J. E. Brooks has been appointed acting general foreman of the St. Louis & San Francisco, with headquarters at Monett, Mo.

Mr. G. W. Taylor has been appointed master mechanic on the Atchison, Topeka & Santa Fe, with headquarters at Arkansas City, Kans.

Mr. C. L. Bundy has been appointed general foreman of the Kaiser Valley Shops of the Delaware, Lackawanna & Western, with headquarters at Scranton, Pa.

Mr. J. G. Glazier, formerly superintendent of the Toleda Terminal, has been appointed superintendent of the Mobile, Jackson & Kansas City, with headquarters at Mobile, Ala.

Mr. B. A. Worthington, first vice-president of the Wheeling & Lake Erie, the Wabash, Pittsburgh Terminal and the West Side Belt Railway, has also been appointed general manager of the three concerns. Mr. Worthington was born in 1861 at Sacramento, Cal., and received his education in the public

B. A. WORTHINGTON.

school at that place. He entered railway service in 1874 as massenger on the Central Pacific, and afterwards became telegraph operator for the same company. From 1877 to 1882 he was commercial operator for the Western Union Telegraph Co., and from this time on until 1895 he was chief clerk and secretary to general master mechanic on the Southern Pacific, and until 1898, was acting in the same capacity as assistant to the president on the same road, and until 1904 held various positions on the Southern Pacific. He was then appointed assistant director of maintenance and operation of the Harriman lines, and in February of the following year, he was appointed vice-president and general manager of the Oregon Railroad & Navigation Co. In June of this year he became first vice-president of the Wabash lines east of Toledo, and in September was appointed general manager of the Wabash Lines east of Toledo in addition to his title of first vice-president. His office is in Pittsburgh, Pa.

Mr. M. Donaldson, formerly general superintendent of the Canada Atlantic, has been appointed superintendent of the newly created Ottawa division of the Grand Trunk, with headquarters at Ottawa, Ont.

Mr. W. O. Maxwell, formerly superintendent of the White River division of the Missouri Pacific, has been appointed superintendent of the Missouri, Oklahoma & Gulf, with headquarters at Muskogee, Ind. T.

Mr. M. W. Maguire has been appointed general superintendent of the Norfolk & Southern, with headquarters at Norfolk, Va.

Mr. J. F. Simms has been appointed superintendent of the Central Kansas division, Northern district, of the Missouri Pacific, with headquarters at Osawatomie, Kan., succeeding Mr. A. De Bernardi, promoted.

Mr. A. H. Webb has been appointed superintendent of the Wichita division, Central district, of the Missouri Pacific, with headquarters at Wichita, Kan.

Mr. John Cannon has been appointed superintendent of the Southern Kansas division, Central district, of the Missouri Pacific, with headquarters at Coffeyville, Kan.

Mr. J. W. Leonard has been appointed assistant general manager of the Eastern Lines of the Canadian Pacific, with headquarters at Montreal, Que., Can.

Mr. George E. Oliver has been appointed general foreman of the Fort Scott, Kan., shops of the St. Louis & San Francisco.

Mr. W. Woods has been appointed foreman of the Megantic, Que., shops of the Canadian Pacific Railway, vice Mr. P. Ronaldson, transferred. Mr. Woods was formerly chargeman at the Ouremont shops of the same company.

Mr. P. Ronaldson, formerly locomotive foreman on the Canadian Pacific Railway at Megantic, Que., has been transferred to the Brownville shops of that company in the same capacity.

Mr. John H. Ford has been appointed general car foreman of the Pen Argyl, Pa., shops of the Lehigh & New England Railroad.

Mr. William H. Walker has been appointed general foreman of the Lehigh & New England Railroad Company's shops and roundhouse at Pen Argyl, Pa.

Mr. J. W. Hendry, fromerly foreman at Rhineland, Wis., has been appointed traveling engineer on the Wisconsin division of the Minneapolis, St. Paul & Sault Ste. Marie.

Mr. John G. Smith has been appointed master mechanic of the Coahuila & Pacific divisions of the Mexican Central, with headquarters at Saltillo, Coahuila.

Mr. C. J. Whereatt has been appointed road foreman of engines on the Great Northern, with headquarters at Superior, Wis.

Mr. J. H. Everhart has been appointed road foreman of engines of the Cincinnati division of the Pittsburgh, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, O.

Mr. J. F. Daly has been appointed assistant road foreman of engines of the Cincinnati division of the Pittsburgh, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, O.

Mr. J. M. Callahan has been appointed assistant superintendent of the Ashland division of the Chicago & Northwestern, with headquarters at Kankauna, Wis.

Mr. J. Burns has been appointed general locomotive foreman on the Canadian Pacific, with headquarters at North Bay, Ont.

Mr. W. H. Fletcher has been appointed locomotive foreman on the Canadian Pacific, with headquarters at Chaplean, Ont.

Mr. Alexander Robertson has been appointed general manager of the Western Maryland and the West Virginia Central, with office at Baltimore, Md.

Mr. W. P. Allen has been appointed supervisor of signals of the Philadelphia division of the Pennsylvania.

Mr. G. C. Smith has been appointed superintendent of the Atlantic & Birmingham, with headquarters at Brunswick, Ga.

Mr. A. Bonnyman has been appointed chief engineer of the Atlantic & Birmingham, with headquarters at Oglethorpe, Ga.

Mr. F. H. Goodyear has been elected president of the Buffalo & Susquehanna, with headquarters at Buffalo, N. Y.

Mr. John Cullinan has been appointed master machanic of the Central Indiana, with headquarters at Muncie, Ind.

Mr. C. L. Eaton, formerly assistant superintendent of transportation of the Chicago, Burlington & Quincy at Omaha, Neb., has been appointed superintendent of the McCook division of the same road.

Mr. H. M. Waite has been appointed superintendent of the Chattanooga division of the Cincinnati, New Orleans & Texas Pacific.

Mr. W. J. Schlacks, formerly superintendent of machinery of the Colorado Midland, has been appointed superintendent of motive power of the same road, with headquarters at Colorado City, Colo. Mr. Schlacks is a son of Mr. Henry Schlacks, who was for many years superintendent of motive power of the Illinois Central and later of the Denver & Rio Grande. He is a graduate of Stanford University and has held important positions in the mechanical department of the Denver & Rio Grande and the Colorado Midland, previous to his promotion on the latter road.

W. J. SCHLACKS.

Mr. C. E. Rickey has been appointed superintendent of the Cincinnati division of the Cincinnati, New Orleans & Texas Pacific, with headquarters at Cincinnati, Ohio.

Mr. R. E. Boswell has been appointed superintendent of transportation of the Cincinnati, New Orleans & Texas Pacific. The title of superintendent of car service has been changed to superintendent of transportation.

Mr. George Durham, traveling engineer on the Cincinnati and Atlanta, Cumberland Valley divisions, and the Knoxville Branch of the Louisville & Nashville, has been appointed general foreman of the same road, with headquarters at Knoxville, Tenn.

Mr. F. D. Hunt has been appointed general superintendent of the Denver, Enid & Gulf, with headquarters at Enid, Okla.

Mr. C. H. Rae has been appointed traveling engineer on the Cincinnati and Atlanta, Cumberland Valley division, and Knoxville Branch of the Louisville & Nashville, with headquarters at Corbin, Ky.

Mr. Charles Bowers, formerly gang boss on the Baltimore & Ohio at Garrett, Ind., has been appointed foreman of erecting shops of the Clover Leaf, with headquarters at Frankfort, Ind.

Mr. M. Marea, formerly roundhouse foreman on the Baltimore & Ohio, at Garrett, Ind., has been appointed road foreman of engines of the Toledo division of the Clover Leaf, with headquarters at Frankfort, Ind.

Mr. F. A. Delano has been elected president of the Wabash, with headquarters at St. Louis, Mo.

Mr. U. E. Gillen, formerly assistant superintendent of the Middle division of the Grand Trunk, has been appointed superintendent of the Middle division of the same road, with headquarters at Toronto, Ont.

Mr. G. H. Horton has been appointed assistant master mechanic of the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Thief River Falls, Minn.

Mr. W. L. Derr, formerly superintendent of the Susquehanna division of the Erie, has been promoted from superintendent of the Hartford division of the New York, New Haven & Hartford, to superintendent of the New York division, with headquarters at New York.

Mr. B. V. H. Johnson, general agent of the Safety Car Heating and Lighting Co. and of the Pintsch Compressing Company, at St. Louis, has been transferred to Philadelphia, vice Mr. F. A. Brastow, deceased.

Mr. Chas. B. Adams has been appointed general agent at St. Louis of the Safety Car Heating and Lighting Co. and the Pintsch Compressing Company, vice Mr. Johnson, transferred.

Mr. L. P. Michael, for years a regular reader of our magazine, has been appointed general foreman of the Cairo division shops of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Mt. Carmel, Ill. Mr. Michael graduated from Purdue University in 1896, and since that time has been in continuous railway service as locomotive fireman, draughtsman and machinist, and for five years has been air brake machinist at Mt. Carmel.

Mr. Frank Burns, formerly general foreman of the St. Louis & San Francisco, has been appointed acting master mechanic of the same road, with headquarters at Monett, Mo.

Mr. J. F. McWilliams, foreman of the Rock Island machine shops at Shawnee, Okla., has been appointed roundhouse foreman at Bucklin, Kan.

Mr. L. Garland, inspector of passenger equipment of the Pennsylvania, has been appointed general foreman of the West Philadelphia car shops, to succeed his father, the late Richard T. Garland.

Mr. William R. Shoop has been appointed purchasing agent of the Buffalo, Rochester & Pittsburgh, with office at Rochester, N. Y.

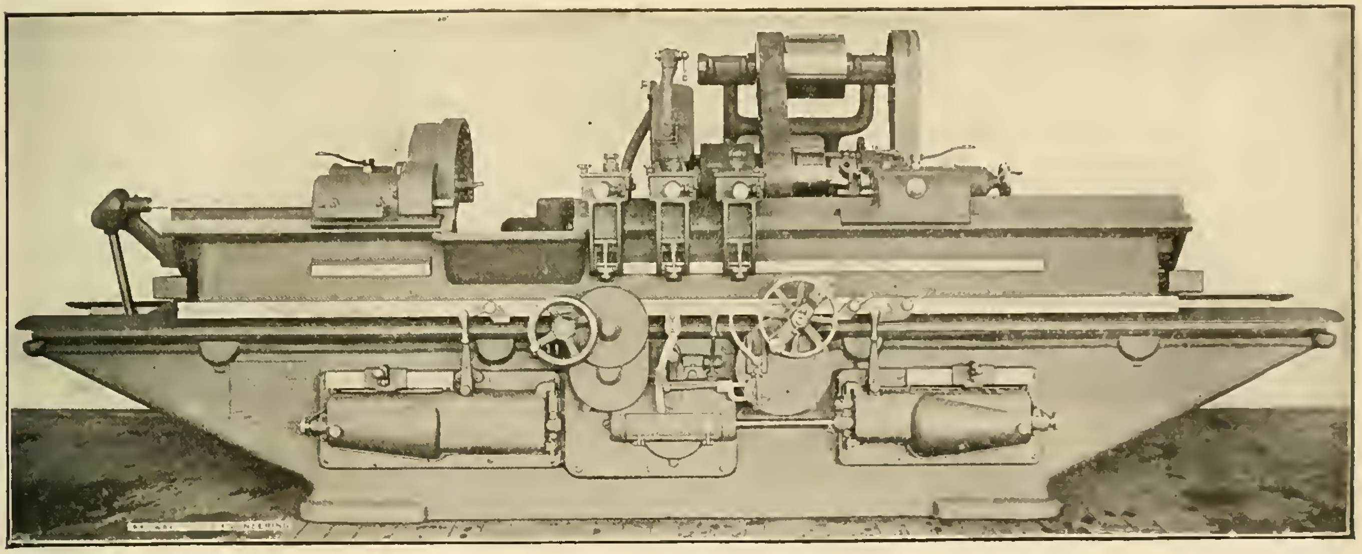
All intelligent readers of engineering literature are familiar with the name Reuleaux, and, to most minds, it is associated with such names as Rumford, Rankin, Regnault, Fairbairn, Marriotte and other luminaries of engineering development. Until last August, Reuleaux was a living entity, but that month he passed away. Franz Reuleaux was a German professor and was author of several engineering books of great merit, and of world wide celebrity. His work on "Strength of Materials" was the best authority on the subject. He was also a high authority on machine design, and on his graphic method of determining the proportion of axles the standard axles for American railroad rolling stock were established.

The evenings are growing long now, and many people remark, "I wish I had something to read that would be interesting and yet would not be waste of time." To such people we say. Send for our "Book of Books." We will send it free, and you may find something in it that will meet your want. It contains brief particulars about many books railroad men ought to read.

Norton Gap Grinding Machine.

This is a machine made especially for railroad work. It has been thoroughly tested by actual use and is in successful operation in shops of leading roads. It grinds piston rods with heads in place; no turning required in repairing old rods; no finish cut in lathe in case of new rods. It also grinds valve stems, crank pins and axles. You can take two piston rods from an engine long in service, and grind them true, round, straight, smooth and ready for use in thirty minutes. Repairing by grinding increases the life of the rod and of the packing. There is a large saving by this method as compared with the old methods.

The Norton Gap Grinder swings 30 ins. in the gap, and takes work 8 ft. long. It has self-contained devices for rapid work. It is of latest improved design, thorough in workmanship, and more powerful and rigid than any other machine built exclusively for this work.



NORTON GAP GRINDING MACHINE.

The machine shown is of the latest design and is noted for rigidity, insuring absolutely true work. The rods finished by this machine effect so much saving in gland packing that engines do more work and cause less delay while under repairs. The machines are made by Norton Grinding Company, Worcester, Mass.

Ten Wheelers May Be Dangerous.

A train on a western railroad known as the "Meteor," met with a serious accident lately, the engine having jumped the track through some unknown cause. We have noticed of late years that many accidents happen on roads when the track is of an inferior quality and the usual tale is that the engine jumped the track without there being any apparent cause for such extraordinary behavior on the part of the wheels. This nearly always happens to trains pulled by ten wheel engines. We believe the design of a ten wheel locomotive involves an element of danger on imperfect track that has not received sufficient consideration. In many cases the weight on the leading four wheel truck is so small that the wheels have nothing to keep them down when anything happens to depress the back driving wheels. A very common case is for the back driving wheels to go down with a jolt on a pair of low joints, the front of the frame teeters up, and if there is a key in the center bolt or the truck, part of the truck is likely to be lifted off the rails. Then the mysterious accident happens which is beyond the comprehension of finite minds.

Report of M. M. Association Proceedings.

The report of the American Railway Master Mechanics' Association for the year 1905 has just been issued. It contains the official proceedings of the association at their thirty-eighth annual convention, which was held at Manhattan Beach, N. Y., last June. The book contains upwards of 400 pages and is uniform in binding and general arrangement with similar publications for former years. A number of interesting papers were presented, the text of which is given in the report. Among the principal ones were reports on locomotive front ends, flexible staybolts, tests of the Pennsylvania at St. Louis, driving and truck axles and forgings, terminal facilities and the heating and ventilating of roundhouses, shop layouts, shrinkage allowance for tires, time service of locomotives and water softening for locomotives.

The officers of the association for 1905-6 are: President, H. F. Ball, of the L. S. & M. S.; first vice-president, J. F. Deems, of the N. Y. C. Lines; second vice-president, William McIntosh, of the C. R. R. of N. J.; third vice-president, H. H. Vaughan, of the Canadian Pacific; treasurer, Angus Sinclair, of Railway and Locomotive Engineering, and secretary, Joseph W. Taylor, 390 Old Colony building, Chicago, Ill. Those desiring to obtain copies of the proceedings should communicate with this office.

British Railway Notes.

COMPARTMENT CARS.

The death recently of a young woman by falling or being thrown from a train while it was passing through a tunnel near London has again raised the regular storm against compartment carriages. This outburst of public opinion recurs whenever such cases as that mentioned arise to give it countenance. It appears to me, however, to be much more determined and insistant on this occasion than previously, but it is doubtful if any good will be done. With revenues falling from many causes, diminished trade and increased facilities for travel and freight transportation in other ways the principal factors, the companies are scarcely likely to abolish the profitable compartment carriage yet awhile. Notwithstanding the retention of these carriages the dead weight per passenger continues to grow as the result of lavatory and other conveniences which even compartments are sometimes provided with. There can be no doubt, however, that competition will ultimately compel the general use of corridor carriages. The traveling public appreciate the greater comfort and diminished fatigue involved in the use of such cars and the companies who recognize this taste earliest and introduce them generally will reap the harvest. It is a little surprising, therefore, at this time of day to find the Caledonian Railway Company placing a sumptuously appointed new compartment train on their Glasgow and Edinburgh route. It is true that the distance is only an hour's run, but I have on more than one occasion suffered an agony of discomfort during that brief period, and, no doubt, such has been the experience of many.

THE BIG KETTLE WINS.

Some years ago I was present at a dinner in St. Enoch Station Hotel, Glasgow, at which the editor of this paper presided. The guests included more than one British locomotive superintendent and the conversation ultimately drifted inevitably to the question of the relative power of British versus American locomotives. It was really a question of big fire box versus big boiler and could only be decided, according to a London official's opinion, by placing one engine of each make, of the same cylinder capacity, tender to tender, coupling them up, and then make them pull. Our editor maintained that the bigger kettle would win. That view has received large support from recent developments in locomotive design in this country, and it is beyond doubt that practical men who have been content to go on increasing heating area, augmenting the volume of simple cylinders to correspond, have obtained highly successful results. But there has been a hankering after strange gods. Four simple cylinders, three cylinder compounds, four cylinder compounds, all have had or are having their turn, but it is a curious feature, common to many of these experimental machines, that they have either had their essential principle modified or abandoned for want of a bigger kettle. Four simple cylinders to compounds, three cylinder compounds to two simple cylinders, cylinders reduced by lining and boiler capacity increased have been some of the remedies. How many thousands of pounds the shareholders of, say, the London & North-Western Railway lost by compounding experiments it would be difficult to assess, but the game still goes on and he would be a foolish man who would prophecy the continuance of an unfavorable result.

COMPOUNDING IN 1905.

So far as the British Isles are concerned it is beyond doubt that this question is further in the background than it has been for several years. With the departure of Mr. Webb, the influence of the arch-apostle of compounding was lost, and the wholesale scrapping of the fruits of his mechanical genius has provided an object lesson little likely to be lost on designers during hard times like these. Still if one can benefit by the experiments of others, there is little harm done, and this is no doubt the view of Mr. Churchwood, locomotive superintendent of the Great Western Railway, who has been using De Glehn compounds for some time. The most recent additions are two four cylinder compounds of 4-4-2 type fitted with Belpaire fire box, Walschaert gear, having 6 ft. 8 in. driving wheels, and 2,700 sq. ft. heating surface. These engines are said to be doing very well, and although the compound probably does not enjoy to the full all the virtues laid to its charge by the Report of the A. R. M. M. Association in 1890, it is something of a puzzle why it does not make greater headway on railways in this country. Whatever the cause, and although there are a number in use, especially on the Midland Railway, there appears to be no enthusiasm in their favor since Webb left. With his successor, Mr. G. Whale, wholly perverted—if he ever was a convert—from compounding, and Mr. McIntosh hardening in his simple engine sinfulness—with most other Scottish railways copying his types—it does not appear as if "London and the North" trains would soon be hauled by the more complex machine.

MOTOR CARRIAGES.

One of the most remarkable developments in railway operation in this country during recent years has been the institution of what are described as "motor carriages" for short rail journey and suburban passenger traffic. From Inverurie in the north to Cornwall in the south, these cars are coming into use. The power varies but steam appears to predominate; internal combustion engines and electric motors are, however, in use, and mention has been made of a producer gas engine in this connection. By the way, I might mention here that the reciprocating engines are being taken out of a steamer of some size in one of the Clyde shipbuilding yards, and powerful internal combustion engines with gas producer plant substituted. The consumption of fuel is about one-third that of the reciprocating engine efficiently compounded. Significant to our motor carriages. Here, in brief, is one in use on the Great North of Scotland Railway, built at their Inverurie shops and engined by A. Barclay, Sons & Co., Ltd., Kilmarnock. The car is open inside with cross seats similar to those in use in America, and is seated for 46 passengers. It is carried on a bogie at one end and is borne by the engine at the other. The latter has a Cochran type boiler with 500 sq. ft. heating surface, and 150 lbs. pressure per square inch. The cylinders are 10 ins. diameter by 16 in. stroke, while the wheels are all 3 ft. 7 ins. in diameter. Walschaert gear is fitted; the brakes are of the quick-action Westinghouse description and Chadburn signaling is in use between the compartments at either end. This style of car with different forms of power is much in use by a number of companies. The largest user is, undoubtedly, the Great Western, but other companies are the London & South-Western, the Midland, Great Central, South-Eastern & Chatham, Great Southern & Western, London & North-Western, North-Eastern, and others. In addition to these cars running on the ordinary railways the companies are bringing into use very extensively road motor cars as feeders to their railways.

MORE POWER, FEWER MEN.

The Amalgamated Society of Railway Servants, who met at Sheffield early in October, had nothing cheerful to say regarding the higher powered locomotives now coming into general use, nor can they view with indifference the serious encroachments of electricity as a motive power. Complaint was made that recent changes had the effect not only of increasing trainmen's individual responsibility from longer trains, electric lighting, steam heating and other improvements but had retarded promotion, reduced the staffs, and assisted to swell the ranks of the unemployed. In 1904 British companies handled 34 millions of tons more freight than in 1901 and received 2½ millions pounds sterling for the work, but they had paid £71,000 less wages in 1904 than three years earlier, a fact in itself which speaks volumes. The remedy suggested for this state of things was an eight hours' day for all railway servants, and the establishment of an organization to embrace all employees of the railway companies. Such an organization is scarcely possible, the interests of the various grades being too greatly at variance.

A CHANNEL FERRY.

It has long been the wish of the railways concerned that a train ferry should be established across the Straits of Dover between Dover and Calais or Folkestone and Boulogne, but harbor and other obstacles—the cost among others, no doubt—have stood in the way. The advantages of such a ferry in the case of fast freight, such as ripe fruit, would be inestimable, to say nothing of the greater comfort to passengers subject to seasickness on board of the vastly larger steamers which it would be necessary to employ. Recently an experiment was made with ripe fruit packed into a suitably constructed car at Perpignan in the South of France, and this vehicle was conveyed the whole way to London. By means of what is called an "æro-thermic" arrangement, the internal temperature was maintained about 42° Fahr. the whole way, so that the fruit was delivered from the car in splendid condition. But it was a very expensive experiment, too costly for repetition except for demonstration purposes. The South of England fruit growers will not be sorry, for they are sufficiently harassed already. So far are they from having their industry protected that it is cheaper to have fruit sent into the London market from Normandy by rail-boat, then rail from Dover, than from mid-Kent—the result of opposition by water and through rates. Nevertheless, that ferry will materialize, and in the not distant future, probably. A. F. S.

Fatal Railroad Accidents Increasing.

There has been so much pressure of public opinion applied to railroad companies during the last two years to increase the safety of railroad travel that we had hoped there would be fewer people killed and injured as time went on, but the last accident bulletin issued by the Interstate Commerce Commission indicates the reverse of improvement. This bulletin gives the number of railroad accidents in the United States for the months of April, May and June of this year, and shows that during that quarter of a year there were 41 passengers and 221 employees killed and 1,253 passengers and 1,511 employees injured in train accidents. Other accidents to passengers and employees, not the result of collisions or derailments, bring the total number of casualties up to 14,669 (886 killed and 13,783 injured).

This bulletin completes the publication of the records of accidents for the year ended June 30, 1905, which in the total number show an increase of 11 killed and 4,123 injured among passengers and employees as compared with the number reported for the year ended June 30, 1904.

The increase in the number killed, says the New York *Sun*, is wholly among passengers, there being a decrease of 106 in the number of employees killed. An increase of 117 in the number of passengers killed makes an increase of 11 in the total killed of both passengers and employees, as above stated. Of the increased number injured, 1,963 were passengers and 2,160 were employees. In coupling accidents, which occur wholly to employees, the total number of deaths, 243, is 35 less than for the year preceding, and the number of injuries, 3,441, is 331 less.

An advance compilation made from annual reports of railroad companies, which, however, is not complete, indicates that the number of men employed on railroads on June 30, 1905, was about 9 per cent. greater than on June 30, 1904.

The freight business of the Pennsylvania Railroad Company has been so active of late, that they have borrowed cars from other roads until they now have over 8,000 cars that do not belong to them. Under the per diem system of charging for the use of cars, the Pennsylvania Railroad Company find the borrowing of cars very expensive, and they are doing all they can to obtain sufficient new cars to do all the business called for.

An estimate of the corn crop gives the figures at 2,521,987,000 bushels raised in the United States this year. Wheat, oats, cotton, hay and potatoes are also all in excess of any previous record. The western railroads especially are taxed beyond their capacity to move the produce.

Temperature Regulation.

Napoleon is credited with saying that he knew of seventeen ways of getting to Great Britain with an invading army, but did not know of any way of getting back. Now, although there are quite a number of ways of heating passenger coaches, up to the present time there has not been any very satisfactory way of regulating the temperature. Like Napoleon's army, the heat could be got to the cars all right, but when there it was difficult to regulate so as to properly do the work that was expected of it, and in this it somewhat resembled the invading army which the master of the art of war knew was impossible to handle in the case before him.

The Gold Car Heating & Lighting Company of New York have recently come forward with a system of temperature regulation for passenger cars which may be described with perfect accuracy as simple and effective. The oldest and most prevalent way in which temperature was raised or lowered—not regulated—in a car, was to let the occupants shiver while the car slowly gained some warmth and at last, when it became too hot, a couple of windows or a few deck lights would be opened so that a cold draught could pour into one part of the coach and cause passengers to sneeze and cough and use language which we would not dare to print in the columns of Railway and Locomotive Engineering.

The Gold system of heat regulation is based on a simple scientific fact. It is that as the pressure of steam rises, so also does the heat which it contains. Steam at the boiling point at simple atmospheric pressure contains 212° F., while at 2 lbs. pressure it is at a temperature of 218° F. Higher pressures give higher ranges of temperature; for example, 30 lbs. pressure has a temperature of 272° F. Profiting by the efforts of others, and working upon this fundamental principle, the Gold people have devised a regulator which controls the steam supply and for that very reason governs the temperature in interior of the car.

Often a coach is compelled to stand for hours in a terminal yard, supplied with steam heat, which in order to obviate the necessity of close watching, is turned on to the full. The car becomes greatly overheated, and all the woodwork joints and interior finishings are kept in a sort of kiln-dried atmosphere which does them no good, and when the car is put in service it is too hot for comfort and has frequently acquired an annoying tendency to creak. There is no sort of economy in this, and an effective system of temperature regulation means the saving of money, and in this connection the system of which we are speaking is rightly termed the Gold system, for that is really that is saves.

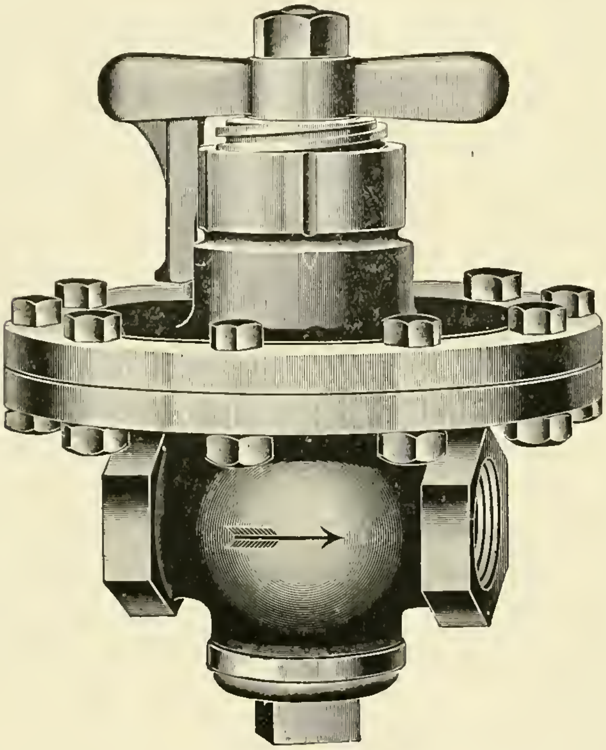


FIG. 1. SIDE VIEW GOLD IMPROVED TEMPERATURE REGULATOR.

The improved temperature regulator which carries on the good work is shown in elevation and in section in our illustrations. In Fig. 2, *D* is an adjusting screw which is operated by the handle *G*. When *D* is turned to the right it compresses the spring *C*, which rests upon a diaphragm. Immediately below this diaphragm is the bottom flange *K*, which, when moved downward, opens valves *L* and *M*. The valve *L* is a small one enclosed in the larger one, *M*. The stem of valve *L* is 1/32 of an inch longer than that of *M*, so that a downward movement of bottom flange *K* opens the small valve *L* first. Spring *N* reseats both valves when the pressure from above is relieved.

The action of the pressure regulator is briefly this: Steam from the locomotive is supplied to the main pipe line under the cars and enters each individual car through an angle cock which is a complete open and shut valve. When this valve is open steam enters the regulator at *R*, and the man in charge of the car sets the regulator at the pressure he deems requisite for the occasion, admitting pressure at 2, 5, 10, 20, 35 or 50 lbs., as the case may be. Suppose, for example, 10 lbs. be admitted while the car is quite cool. Steam at a temperature of 240° F. passes through valves *L* and *M* and finds its way to the radiating coils from the opening at *S*. This pressure acts upon the underside of the diaphragm and tends to push up spring *C*. If the car is cool the radiation of heat and the consequent condensation of steam takes place rapidly and the pressure below the diaphragm falls slightly and the opening through valves *L* and *M* is maintained or slightly increased, according to circumstances. When the car becomes warm the radiation of heat and the condensation of steam decreases, and the pressure under the diaphragm then becomes sufficient to close the valves, or at least permit the large valve *M* to seat, and so reduce the supply. The area exposed to steam pressure of valves *L* and *M*, together with the tension of spring *N*, is sufficient to equal the force of spring *C*, so that in all cases the movement of the diaphragm is governed by the pressure above or below it.

When the car gets to a temperature where the condensation of the steam in the heater coils is at its minimum, the pressure under the diaphragm closes the valves and cuts off the supply until the temperature falls, and then more steam is automatically admitted to the heater system of the car. The regulator is so designed that it can never be absolutely shut off by the man in charge, its minimum capacity being the supply of 2 lbs. pressure. This is done so that when in operation a slight pressure is maintained in the pipes which keeps the water of condensation constantly on the move toward the drip.

The problem of heating a passenger car is not like that of a large building for the simple reason that the car in its travels may move through a territory in which very great changes of temperature are encountered. For this reason heating with exhaust steam, which requires the water of condensation to be constantly pumped or forced out, is not the system which is here applied.

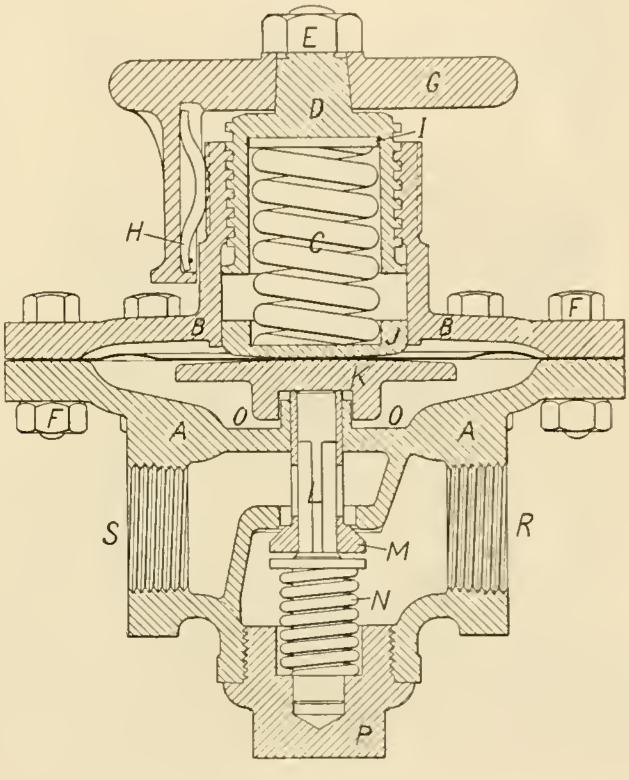
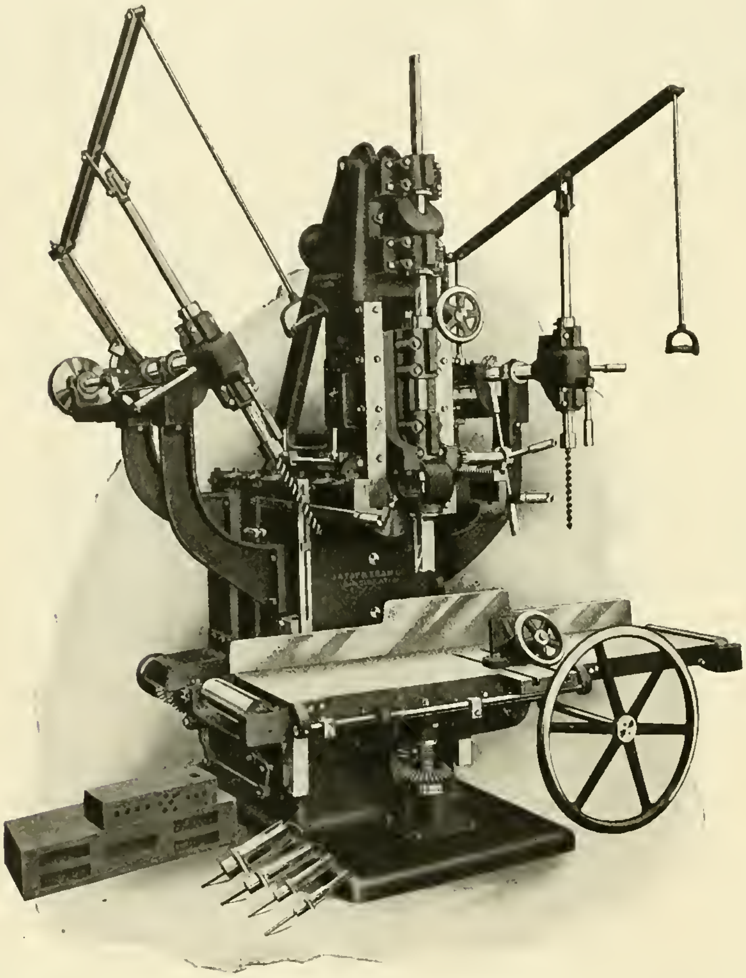


FIG. 2. SECTION OF TEMPERATURE REGULATOR.

The positive pressure of live steam is required, and when this is regulated, it insures economy in operation and maintenance, and it greatly increases the comfort of the patrons of the road which uses such means of regulation, and the good will of the public has its commercial value to any transportation company. In fact, it is worth its weight in Gold, and that happens to be the name of the New York company to whom you should apply for any further information on the subject.



HOLLOW CHISEL CAR MORTISER.

New Mortiser.

It has been our aim to show to our readers the latest developments in the machinery line, and for this purpose we select a hollow chisel mortising machine, made by the J. A. Fay & Egan Co., of Cincinnati.

This machine has just been finished, and has been fully tested. It has been especially designed for car builders and represents an evolution from previously made tools of this kind which, in their day, met with success.

The frame is very heavy, and has a wide base. The housing is gibbed firmly to the frame, with provision for taking up wear, and has a lateral movement, by hand wheel, for moving the chisel to its required position. The chisel ram is gibbed to the housing and carries the boring spindle that prepares the material for the chisel thrust. This boring spindle runs in a long, self-oiling bearing in the frame. The boring spindle in the chisel is driven by mitre gears. The chisel has a stroke of 7 inches and will mortise to the depth of 6 inches at the rate of twenty strokes per minute. The ram has a vertical adjustment of 10 inches. The extreme lateral motion of the housing is 17 inches. The table for supporting the material is 6 feet 6 inches long. It is raised and lowered by power, thus giving quick return to the chisel.

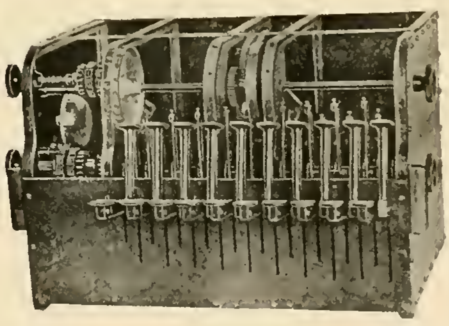
The reciprocating motion of the chisel ram is produced by elliptical gearing. The Auxillary Boring Attachments are driven by independent countershafts. The auxiliary boring attachments are placed one on each side of the frame, at such distance from the chisel as will permit of adjusting them to an angle of thirty degrees in either direction. The spindles have a vertical stroke of 18 inches and a lateral adjustment of 14 inches.

To Aid in Adjusting the Train Loads.

At the October meeting of the New York Railroad Club, Mr. J. M. Daly, car accountant of the Illinois Central, presented a paper on Loading of Locomotives. The most important feature of the paper was the recommending of an apparatus for calculating mechanically the proposed load of a train.

The necessity for an improved method of figuring up was well explained in the following paragraphs of the paper:

"The tonnage footings on conductor's reports of to-day are very inaccurate. Imagine the average yardmaster or conductor, after taking the initials, numbers and seals, on fifty to sixty cars, also looking the cars over for defects, then go to the office and get his bills, enter the contents and tonnage of each car in his book, then try to foot up his tonnage correctly while standing at the counter along with others, trying to get his running orders and make out reports to the chief dispatcher, showing the consist of his train. He has so many things to think about at one time that I am surprised he computes his tonnage as accurately as is done. A conservative estimate is 70% of the reports so compiled are inaccurate, and some place it at 85%. Invariably, the tonnage reported is higher than the actual tonnage hauled. What would be the result if we place additional burdens on the conductor by having him carry a chart with him to adjust or reduce from gross weight to drawbar-pull each car



TONNAGE REGISTER. PLATE A.

in his train? That is difficult for expert clerks to handle, in a comfortable, quiet office, where their minds are constantly on the work of adding, but put them out in a yard in rain and snow, with the responsibility of a train on them, and their work in adding would be no better than that of the conductor's.

"Again, each part of a train district or division chould receive independent and complete supervision, in order that the result of the whole may be successful, and the officer in charge should know that all trains moving over any part of his division in the direction of heavy traffic pulled their full rating, and reports of this kind will enable him to dispel any doubts from the minds of his superior officers that he is not moving his maximum tonnage at the minimum of expense.

"From these figures the officer in charge will have no trouble in determining where it will or will not pay to reduce grades."

The computing device of which we show three illustrations is thus described:

Plate (*A*) represents the train ton-

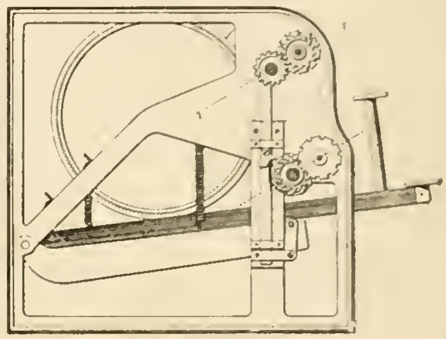


PLATE B.

nage equating machine, which is constructed somewhat similar to a cash register. The case at top and front is removed, to show the inner mechanism. The keys with numbers 15 to 70, arranged outside the case, represent the gross tons of car and contents, as shown on waybills. The numerals at the lower left-hand corner represent the number of cars in train, the numbers at the left on top represent the drawbar-pull tonnage, equated from the actual tonnage. The bell at the left side sounds automatically when the limit of cars allowed on one train has been reached.

Plate (*B*) furnishes a side view. At the right attached to large wheel, is a clutch that grips the large wheel and causes it to move the distance the key moves down. This wheel causes the numeral wheel 0 to 99 to move sufficient to register the number of tons called for by the key employed. At the right on top is a compounding wheel on which numbers 0 to 99 are located, and alongside this wheel is a guide yoke with small adjustable screw at top, which is attached, and moves with the key in motion. The screw in guide yoke comes in contact with the irregular face on the small cam wheel immediately under it and causes the key and numeral wheel to stop at a predetermined point. This cam wheel has the irregular faces so arranged that when numerals of cars in train and tonnage is set at "o" before starting to compute the tonnage, the shoulder at the highest point is immediately under the screw in guide yoke—hence when you press key for car of 60 gross tons next engine the guide yoke strikes cam as set and the register shows 51 tons. A second operation of same key register would show 102 tons, then press key 15 it would show 110 tons. When a total of ten cars have been computed, be it the same key ten times, or ten different keys one movement each, the bar on which these cams are attached and carried revolves one-tenth, which causes a shoulder slightly lower than the first to come into position under each key, hence if you operate key 60 for the eleventh to twentieth car it moves a trifle further before striking the cam and causes the register to show 52 tons instead of 51, and the 15-ton key would now register 18 tons instead of 17, this in order to provide for the additional drawbar-pull causes by distance of car from the power. The irregular face on the cam wheel is cut or adjusted under each key to control the numeral wheel and cause it to register and record the drawbar-pull of any gross weight of car at each location of car in train, thereby making proper allowance to engine when heavy cars are placed at the rear and light cars at the head end of train—in addition to automatically reducing the gross tons to drawbar-pull.

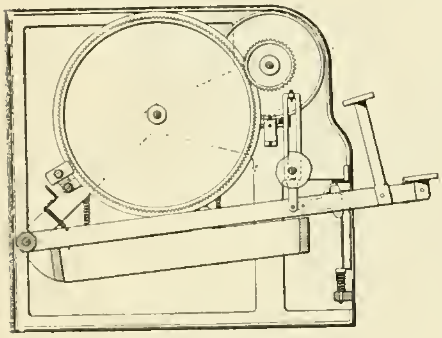


PLATE C.

Plate (C) represents end view showing at top the tonnage numeral wheels, and at the bottom the wheel which records the total number of cars in train and changes the position of cams at pre-determined intervals—every tenth or fifth car as desired.

This machine is intended for use in the office of the yard master where waybills are kept, and the tonnage to be computed on machine by the clerk—a machine to be placed at ends of all train districts and at important intermediate filling-out stations, in order to not only adjust correctly the drawbar-pull of trains, but to take away from the trainmen the work of computing their tonnage and avoid all chance for error and light loading, which is invariably the case at present.

Accuracy Desired.

The Baker City (Ore.) *Herald* has the following news item, which shows a commendable thirst for accurate railroad information. It says: It was rumored yesterday that the O. R. & N. was going to put in three new ties and a frog in the local switch yards. Realizing the error of our ways in the past on railroad news, we determined to follow the example set by the only authoritative railroad sheet in the State, and, accordingly, we telephoned Mr. J. P. O'Brien, the Oregon boy, whom to know is to love, and received the following, which made us feel as if an annual pass wasn't so far off, after all: "No truth in the rumor as to frog. Ties correct." There you are.

We often get letters approving of the stand taken by RAILWAY AND LOCOMOTIVE ENGINEERING, and sometimes we get letters where criticism of our opinions is the dominant note, but we lately had the pleasure of seeing a man who came to the office to personally thank our chief editor, Mr. Angus Sinclair, for the stand he had taken at the last M. M. convention regarding the status of the railroad fireman. Among the remarks which were made on that occasion were these, which seemed to strike a responsive chord in the heart of our friend. Mr. Sinclair said: "Everything ought to be done to help that man (the locomotive fireman) so there should be no unnecessary increase of labor laid upon him. The coal should be moved ahead at water stations, but that practice is very much neglected to say the least about it."

The report that the Grand Trunk shops at Port Huron, Mich., were to be removed is, to say the least, premature. The shops there are to be extensively enlarged, offering employment to 300 additional men. The present force number over 400. The enlargement is chiefly necessary by increased need for freight cars.

During eight months of the present year, 345 American locomotives have been exported to foreign countries, of which Japan received 25. The others are distributed among the South American Republics and Canada. Their total valuation was $2,941,416.

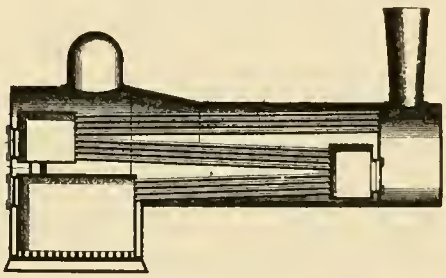
The new shops of the Missouri Pacific, at Sedalia, Mo., have been opened, and much trouble has been experienced to find accommodation for the great influx of workmen. When in full working order over 2,000 will be engaged.

The Norfolk & Western Railroad Company is in the market for from 3,000 to 5,000 cars in addition to 300 coke cars being built in the company's shops.

Reviving the Combustion Chamber.

Throughout the whole course of years that the locomotive has been in use, there has been a succession of periods when it was the prevailing fashion to put upon it some invention or reported improvement which was glorified for a brief period and then fell into innocuous desuetude. Every railroad carrying the burden of gray hairs can recall various fashions that had a brief popularity and then went to oblivion.

Among the very earliest attempts to extract the elusive heat units from fuel was the combustion chamber. The applying of combustion chambers was a fashion that raged for a time and the locomotive designers had numerous relapses of the complaint in mild form even to times within the memory of infants yet in short garments. We illustrate a recent attempt to revive the combustion chamber fad and it is really ingenious and ambitious. The picture tells the whole story. It is proposed to pass the gases of combustion from the fire box to a combustion chamber near the smoke box, then back to a second chamber above the fire box close to the back head; from thence they will be permitted to pass to the smoke box. It is a great scheme, but we are afraid that the gases would be of a refrigerating rather than of an evaporating temperature before they reached the smoke stack.



LONG ON COMBUSTION CHAMBERS.

The inventor and patentee of this form of boiler is Charlie Bioly, Beaver, Wis.

"Speak of Me As I Am."

Stating a plain fact is not by any means necessarily self-glorification, and giving our readers this one will do no one any harm and may strengthen the faith which is in most of our friends. One of our very successful club raisers at a large railroad shop in the West recently said to Railway and Locomotive Engineering that the magazine spoke for itself when a sample copy was given to an intelligent railroad man, be he shop hand or on the road. It seems that an esteemed contemporary of ours had made an effort to obtain subscribers at the point in question (we say "esteemed contemporary," and we mean it, for the paper we speak of is a good one. Railway and Locomotive Engineering is not looking for any prizes in a walk-over race). Our magazine and that of our contemporary was for the time handled by the same man who did not boom either one above the other, but handed sample copies of both papers to prospective subscribers at the same time, bidding the reader take his choice. He acted on the words of Othello where he says: "Speak of me as I am; nothing extenuate, nor set down naught in malice." In over ninety per cent. the choice fell upon Railway and Locomotive Engineering as being what was required by practical railroad men, who, as one engineer recently put it, "Want to know as much as the officials of road know," and, therefore, take it and read it regularly.

Locomotive building for the Panama Canal construction work is going ahead in earnest at the Schenectady shops of the American Locomotive Company. Twenty-four engines have already been built and an order for 120 more of the same class has been placed with this company. The engines are of the 2-6-4 type, with side and rear tanks, having a water capacity of 3,700 gallons and a fuel capacity of five tons. They have been designed with reference to handiness in operation, and the canal people will have the advantage of absolute similarity of their motive power throughout. The weight of one of these machines in working order is 183.500 lbs., of which 124.000 is carried on the drivers. The cylinders are 19x26 ins. and the gauge of the track is 5 ft. These engines will be used on the main line for steam shovel work and when they all get busy something will have to give way.

The Norton Grinding Company, Worcester, Mass., have issued a handsome circular calling attention to their improved grinder, which is made especially for railroad work. It is perhaps the most powerful machine of its kind now made, having the element of rigidity in a marked degree. In grinding piston rods its value cannot be overestimated, the perfect smoothness of finish effecting a great saving in packing. The circular describes the simple methods used in grinding piston rods, valve stems, crank pins, axles and other work.

The Falls Hollow Staybolt Company, of Cuyahoga Falls, O., have just received a large order for hollow staybolt iron bars for export to the Imperial Railway of North China and also an order for a supply of the same material for the Imperial Railway of Japan.

Railroad Literature.

The motto on the seal of the State of Connecticut—*Qui Transtulit Sustinet* (He who brought us hither will sustain us)—was the crystallization of a beautiful thought naturally arising in the minds of the Pilgrim Fathers and other early settlers who cleared their way heroically through the trackless wilderness. The conditions that confronted them no longer exist, but the same resolution and courage that manfully meets and masters difficulties, and the same patience that never wearies, are just as necessary to success in every walk of life today as it was to these Puritan pioneers. To none is this more true than to the young mechanic or engineer who has chosen the construction or manipulation of the mechanical appliances used on railways as his calling. In some respects the difficulties grow with the coming years. There is no royal road to a mastery of the multiplying details of such a calling. Success necessitates that our lives must be characterized by study and observation and the intelligent utilization of the results of both. The successful railroad man of to-day is the man who has made the best of his oportunities to study the principles underlying his art or occupation, and has taken to heart and profited by the lessons taught by the successes and sometimes even by the failures of others.

In such a case railroad literature is indispensable. It should be of a kind that maintains a high standard of value to the student. The qualities of clearness, brevity, and thoroughness should distinguish such matter, and in these essential elements it has been the constant aim of the promoters of Railway and Locomotive Engineering to present an illustrated journal of practical railway motive power and rolling stock which has been universally acknowledged among railroad men to be the most potential educational factor in this department of our time. The price, $2.00 a year, delivered monthly to any address, places it within the reach of every railway employee.

"Twentieth Century Locomotives," Angus Sinclair Co., deals comprehensively with the design, construction, repairing and operating of locomotives and railway machinery. First principles are explained. Steam and motive power is dealt with; workshop operations described, valve motion, care and management of locomotive boilers, operating locomotives, road repairs to engines, blows, pounds in simple and compound engines; how to calculate power, train resistance, resistances on grades, etc. Shop tools explained. Shop receipts, definitions of technical terms, tables, etc. Descriptions and dimensions of the various types of standard locomotives. The book is well and clearly illustrated and is thoroughly up to date in all particulars, fully indexed. Just off the press. Price, $3.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. The price of it is 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. The price is 75 cents.

The 1904 Air Brake Catechism. Conger. Convenient size, 202 pages, well illustrated. Up to date information concerning the whole air brake problem, in question and answer form. Instructs on the operation of the Westinghouse and the New York Air Brakes, and has a list of examination questions for enginemen and trainmen. Bound only in cloth. Price, $1.00.

"Compound Locomotives." Colvin. This book instructs a man so that he will undestand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all abount running, breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion, it is easily understood by every intelligent fireman. The price is 50 cents.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable, and, best of all, they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Standard Train Rules." This is the code of train rules prepared by the American Railway Association for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ ins. of closely printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotive. Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

Drops of Water and Lampblack.

The following interesting home experiment detailed in the columns of the *Buffalo Express*, has been reprinted in *Graphite* for October, 1905. This latter publication is the house organ of the well-known Joseph Dixon Crucible Company, of Jersey City, N. J. This firm is an authority on graphite in all forms and in all commercial uses, especially when employed as a lubricant or in lead pencils. They are also the makers of a graphite paint for protecting steel surfaces. The success of the experiment depends upon the fact that lampblack coated paper presents an almost frictionless surface to the passage of drops of water, which are inclosed each in its own invisible sack or skin, usually called the surface film, and, moreover, under the circumstances, the lampblack has no tendency to break the surface film of the drop and, therefore, no tendency to mix.

The experiment is given as follows: "Take a strip of strong paper about 4 ins. wide, and as long as you can get. Several pieces pasted end to end will do. Pass the paper over the smoking flame of a lamp, or, better yet, cover one side with electrotyping graphite. Place on end on the table several books of gradually decreasing size. Spread the strip of paper over these so that it assumes the form of a house roof, from the large book toward the small ones. At the end let the paper fall into a plate. At the other end, where the large book stands, pour water, drop by drop, on the paper. These drops will run down the inclined plane; then, in consequence of the momentum acquired, will jump over the back of the second book, and thus following one another they will reach the plate. The spectacle of these drops of water rising and falling by turns, and seeming to compete in liveliness with each other, is most curious." Try the experiment when you have time and tell the Dixon people how you found it.

Air Power is a neat little publication which has been running for a year. It has been got out by the Rand Drill Company, of New York, and has contained articles illustrative of the various uses to which compressed air is put in railroad service. It is well illustrated and very neatly printed. The Rand people, however, announce that they will discontinue the publication of *Air Power* for the present. Copies of the last number can be obtained on application to the company, No. 11 Broadway, New York.

J. A. Fay & Egan Co., the big woodworking machinery firm of Cincinnati, Ohio, have lost one of their great designers, Harry Smith Spencer, who died very suddenly at his home in Cincinnati, August 19, 1905. Mr. Spencer was not exactly their head man, but was tending that way very much. He was brought up in their employment and never was enticed away by any other firm. He knew all the old and new patterns and drawings of the firm, and his 20 years' experience made his services invaluable. Regarding Mr. Spencer's ability, Mr. Thos. P. Egan, the President, says: "There was no man his equal in the United States, or we would immediately hire him. Designers of his caliber are scarce, as his ability amounted to absolute genius." Mr. Egan despairs of finding a young man to fill the vacancy, and will probably have to grow another. He is open, however, for negotiations or proposals from any one in this country.

The Duff Manufacturing Company, of Pittsburgh, makers of the Barrett jacks, have burst into song, and have just issued an artistic little pamphlet recording in melodious verse the story of Archimedes and his promise to move the world. The verses close by a happy reference to the absurdity of the philosopher making such a promise without having one of the Duff jacks ready to hold the world in place when moved. There are two certain things about the story. The Romans cut short the career of the old Syracusan before he had begun his promised undertaking. Duff's jacks are doing all that the Duff Company have promised that they can do. Performance speaks louder than promise.

The United States Metallic Packing Company, of Philadelphia and Chicago, have issued a fine new catalogue descriptive of their popular metallic packing. Their numerous devices are designed to meet every kind of work, and in the important element of flexibility their vibrating cup-and-ball joint permits the packing to follow the rod when the inevitable lost motion occurs between crossheads and guides. This peculiarity has given their packing a high place in modern steam engineering practice. The catalogue gives minute descriptions of their various methods and improvements in piston, valve-rod and pump packing. The numerous illustrations are in the highest style of the art.

Baxter D. Whitney & Son, manufacturers of woodworking machinery, Winchendon, Mass., have issued a finely illustrated, large catalogue descriptive of their extensive variety of woodworking machinery. The catalogue is particularly interesting, embracing as it does the history of the rise and progress of the works, a biographical sketch of the founder—a man of striking and forceful personality; reproductions of interesting scenes, portraits, medals and a large number of finely finished illustrations of every conceivable kind of woodworking machinery manufactured by them.

A new bulletin has just been published by the David Bell Engineering Company, Buffalo, N. Y., in regard to their new improved steam hammers. The Bell Engineering Works have long enjoyed deserved popularity for the excellence of their work. During the present year a large number of orders have been received by them for steam hammers from the U. S. Government to be used at Panama, Boston, New Orleans and Mare Island. A new feature of their hammers is the introduction of two strong spiral springs under the reinforced cylinder flange, to cushion the up stroke and prevent injury in case of careless handling, a clearance being left between piston and cylinder head when springs are solidly compressed. The illustrations in the bulletin are in the finest style of the art.

A neat little catalogue came to our office a few days ago which bore the title "Genuine Armstrong Stocks and Dies." The name of the firm, the Armstrong Manufacturing Company, at once suggests the other name by which they are so often called—The Tool Holder People. This concern make all sorts of tools for water, gas and steam fitters and machines for cutting off and threading pipe. In the pages of this catalogue they warn their customers, when ordering special dies for brass pipe, etc., that it is advisable to give the outside diameter of the pipe, and when ordering for foreign countries it is necessary to specify the kind of thread required; that is, whether the English (commonly called the Whitworth) or the U. S. standard for pipe, and if threads for bolts have to be cut, the makers wish to know if the Whitworth, the V-thread or the U. S. standard is preferred. The catalogue not only gives the sizes of the dies and other information concerning them, but it gives the price. There are 48 pages in the little book, and the illustrations are many and of good quality. In fact, this publication is useful for reference as to what is on the market in the line of tools made by the Armstrong Company. A copy of the catalogue may be had by applying direct to the company, whose headquarters are in Bridgeport, Conn.

Mr. J. W. Duntley, President of the Chicago Pneumatic Tool Co., recently returned from Europe. While abroad the Fraserburgh and Berlin factories were started and manufacturing arrangements perfected in Russia. All factories are now running with sufficient business to keep them constantly occupied for several months, and the outlook generally is the most satisfactory of any period in the history of the company. Mr. Duntley brought home with him several large contracts, including orders for several hundred Air Cooled Duntley Electric Drills. While in England and on the Continent, several tests were made with the result that the sample tools used by Mr. Duntley accomplished the work in such a satisfactory manner that this branch of the business has now been established on a substantial basis. Domestic inquiries for all classes of tools and appliances, as well as compressors, are numerous, as many as forty compressors being quoted upon in a single day. Large orders for compressors and tools have been received recently, among which were the following: Compressor and complete equipment of pneumatic tools for the Western Steel Car & Foundry Company, Hegewisch, Ill.; three compressors, each with 750 cubic feet capacity, for the Baltimore & Ohio R. R.; one one-thousand foot compressor for the Huntington shops of the Chesapeake & Ohio R. R.; one twelve-hundred foot compressor for the Norfolk & Western R. R., Cleveland, Ohio.

The Billings & Spencer Company, of Hartford, Conn., have published a 40-page illustrated catalogue descriptive of their drop-forged machine wrenches. A complete list is furnished of every imaginable size and angle of wrenches with milled openings, semi-finished, or finished. The material is carefully selected by the company, the forgings are perfect in every way, while the prices seem to defy competition.

The Merchant & Evans Company, of Philadelphia, report a marked increase in business during the current year. In the production of tin and terne plates, solder, linotype, stereotype, electrotype and babbitt or anti-friction metals, their work is unversally admitted to be of the best quality. The company has gradually attained to their present eminence after twenty-five years of painstaking endeavor and the employment of the best chemists and others expert in metals.

The Pratt & Whitney Company, the well-known makers of machine tools, have purchased a plant in Dundas, Ontario, for the manufacture of their full line of small tools, viz.: Taps, Reamers, Milling Cutters, Punches, Dies, etc. The building, which they have secured, is a modern structure, and the power plant is already in place. The machinery equipment is being got ready at Hartford and will be sent there and operations will be begun immediately. The plant will include a department for manufacturing a full line of Twist Drills, an elaborate equipment of special machinery having been prepared for the purpose. The location of the factory is near that of the John Bertram & Sons Company, which, as has been announced, was recently purchased by the Niles-Bement-Pond Company. The town of Dundas is a few miles from the city of Hamilton, Ontario.

The American Brake Company, of St. Louis, Mo., have issued a very useful catalogue dealing with the American Automatic Slack Adjuster. The illustrations with which the catalogue abounds make clear the operation of the device and the letterpress gives a full description of the apparatus. The names of all the parts are given so that in ordering the correct word may be used in all cases. There are eight styles of adjusters listed, and prices of full equipment and parts will be mailed upon application to the company, and so will a copy of the catalogue.

The Long Island Railroad Company has placed the largest order for new equipment in the history of the road. Twenty-five of the largest type of passenger locomotives and seventy-five steel passenger cars will be added to the rolling stock as speedily as possible. The new president, Mr. Peters, although in office only a few months, has been quick to appreciate the opportunities offered for increasing the business of the road.

The gross earnings of the Chicago Great Western Railway, Maple Loaf Route, for September show an increase of $101,816.07 over same month last year.

Niles-Bement-Pond Co. have purchased the plant of The John Bertram Sons Co., at Dundas, Ontario, where they will continue to make the line of railroad tools which the Canadian shops have been for years turning out.

The complete equipment for three trains is being built at Pullman, Ill., for the Lake Shore Railroad to be used on the Pittsburgh Limited. In point of elegance they will surpass anything previously owned by the company.

The Mexican Car and Foundry Company, at Hutchinson, Mexico, are building 175 coal cars for the National railroad lines of Mexico. The capacity of the cars is 80 000 lbs. and the price is said to be $120,000 in gold.

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

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A Highland Railway Terminus.

The subject of our front page engraving is the terminals of the Oban Railway, at Oban, on the west coast of Scotland, a most picturesque ending of a railway that extends from Dunblane sixty miles away through a series of rugged Highland glens seldom equaled in scenic effects. The line is essentially a tourist route, but the pretty town of Oban is both a summer and winter resort of hypochondriacs and health-seeking people. The place is also an entrepot for receiving Highland products and for sending out supplies necessary to keep people alive in the mountain glens, haunts of storms and life-exhausting winter weather.

These West Highlands are a chaos of shapeless mountains, torn into fragments by the stupendous forces of sea waves, dashing rains and eroding frosts. Yet their weirdness and heterogenousness are impressive to the beholder. The passions of inanimate nature have been waged hereabout so tumultuously that one naturally expects to hear that the human denizens have been wild warriors and truculent neighbors which they certainly were.

Yet this region was the first in Scotland to receive the teaching of Christianity. Perhaps the early missionaries who preached the Christian gospel thought this region needed it most. Be this as it may, it is certain that Columba, an Irish Christian missionary, took up his abode on Iona, a small isle near Oban, as early as 563. He is said to have built a church which was the rallying point and refuge of early Christian teachers, and was afterwards destroyed by the piratical Norsemen; but other churches were built later and the isle is now famous for ecclesiastical ruins and relics. From here Christianity was spread all over Scotland and a few centuries later a powerful delegation of the Irish, then called Scots, who had sent the glad tidings into Scotland, came along across the intervening estuaries and took possession of the country. There had been an aboriginal race on the land called Picts, who were soon crowded out of home and holding or absorbed by the Irish-Scots immigrants.

A HIGHLAND RAILWAY TERMINUS.

The chief of these immigrants, sometimes called robbers and pirates, built a strong castle on an isolated rock on the mainland and made it his military and subduing headquarters. The name of this stronghold is Dunstaffnage Castle, to-day quite a formidable ruin. After a time the descendants of the warrior chief became kings with need for extended room to sustain themselves and followers. That necessity, ever the mother of invention, found means to transport a powerful part of the colony to Perthshire in the heart of Scotland, where their king desiring tendencies were nurtured by the products of a fertile country.

The Irish missionary-pirate immigrants took possession of Scotland, sure enough, and gave it their name. By combination with other tribes and races they laid the foundation of a nation which eventually fought the conflict for popular freedom against kingly and aristocratic autocracy. Scotland and the world owes much to the Irish immigrants, who, knowing a good thing, took possession.

OBAN, A HIGHLAND RAILWAY TERMINUS.

The people in all lines of duty who do the most work are the calmest, most unhurried people in the community. The calm spirit works methodically, doing one thing at a time and doing it well, and it therefore works swiftly though never appearing to be in haste.

A curious case of corrosion has been noticed on the surface of the rails of the New York Subway. It is so slight that no evil effects are likely to result from it; but General Manager Hedley is positively reticent about its cause or origin. He fears that if New York City reporters get onto it, they will make this corrosion the subject of so much sensational and alarming discussion that travelers will perceive a new danger to people using the Subway.

Way Engineer Skeevers Illustrates a Point.

Jim Skeevers runs a freight engine on a road where the men do pretty much as they please—so long as they pull the trains. To be sure, there is a monthly bulletin of coal and oil used and repairs made, but no one is censured for using too much or complimented or paid for using little. The firemen are not required to clean much and—it's a pretty easy place to get along.

But Skeevers prides himself on economy of fuel and oil, in doing his work well, and getting along with a reason for everything. Among other things, Skeevers likes to see his engine wiped off and the front end and stack neatly blackened, and Skeevers' fireman generally has the neatest looking engine on the road.

Other firemen quit cleaning cab brasses, wiped the jackets about once a week instead of daily, and quit painting the front end altogether long ago. Then they guyed Skeevers' fireman, and called him a fool and a sucker and a chump, till Skeevers' fireman got sick of it and struck for liberty. He didn't wipe the dust off her, and she went out with her front end looking pretty scabby—for Skeevers.

When Skeevers got to the engine in the yard the other day he put his siege-can in the box, got out his overclothes, put them on, and started around with the long can. Billy sat on his seat and smoked a cob pipe.

Skeevers got up on the deck, wiped off his can, and remarked rather hintfully:

"Forgot to dust her off this time, didn't ye, Bill?"

"No," said Bill, "I got sick of being guyed by the rest of the gang, and called names, and bein' accused of trying to make firemen do more work, and cleaning for my ride after firing for my day's pay, and all that."

"Billy," said Skeevers, "it's all right; don't blame you at all. It takes a long time to find out that you know your own business best. Now, haven't you often heard it from all quarters that we had the best-looking engine on the road? Yes, 'course you have. Don't she run lightest on coal and on oil? Never was beat. Do you have to wipe a dose off her once a year because she was too full of water? No; because we are careful and take pains in our work. We may be suckers, but it's a good deal of satisfaction for me to know we're doin' our work about right—near as we can, anyhow. But it's wrong, I guess, Billy, dead wrong, after all. So let's do as the rest do; you fire and clean just as the other boys do, and I'll run just as the other runners do; there's no use in bein' odd."

Billy had expected a row with Skeevers, and felt quite relieved that he took to the change so good naturedly, and in a few minutes both were busy, as they pulled out with a big train.

Skeevers jammed the injector on full just as they started, and Billy had a hard half-hour's work bringing his green fire up, with the pressure down 20 lbs.; he was tired and sweaty when the engine commenced to churn water through her stack, plastering the front windows with dope. Skeevers jerked his head inside the window, smiled, said he forgot it, shut off the injector, and eased off the throttle, then she commenced to howl and Billy opened the door.

Skeevers was working her down a notch further than usual, and it told on the coal pile, and Billy remarked that it was an awful hard pulling train, by way of calling Skeevers' attention to it, but Skeevers agreed that the train did pull hard.

Skeevers forgot to put the injector on again till the water was down to one gauge, then he acted startled, and put it on full. The fire was low, and Bill had another fight. This was repeated all day, and each time the coal got further and further away.

Half-way over the division they took 150 bushels of coal, where they never took more than 100.

Skeevers kept good-natured. Bill was mad.

"I think you're doin' this a-purpose," said Bill, at last.

"Doin' what?" asked Skeevers, as innocent as a child.

"Why, pounding this engine so hard, and workin' water, startin' out in the corner, wide open, and pullin' my fire all to pieces."

"Is there any other engine on this road that don't burn more than 6 tons of coal over this division?" asked Skeevers.

"No; but she never burnt but 4½ and 5 before," said Billy.

"Yes, but that was when we was both careful and worked together," said Skeevers, as he prepared to get off at the end of the run; "but none of the rest of the engineers are careful about coal; what's the use of me being? And when a man works as hard as you have to-day he would be a fool to put in an extra hour cleaning and fussing around; we get just as much money when we don't as when we do. Good night, Billy"

The next morning when Skeevers came down to go out, the "Mary Ann" was wiped up, her front end black, and Billy was whistling "Annie Rooney" and spitting on the side windows to make the whiting take hold.

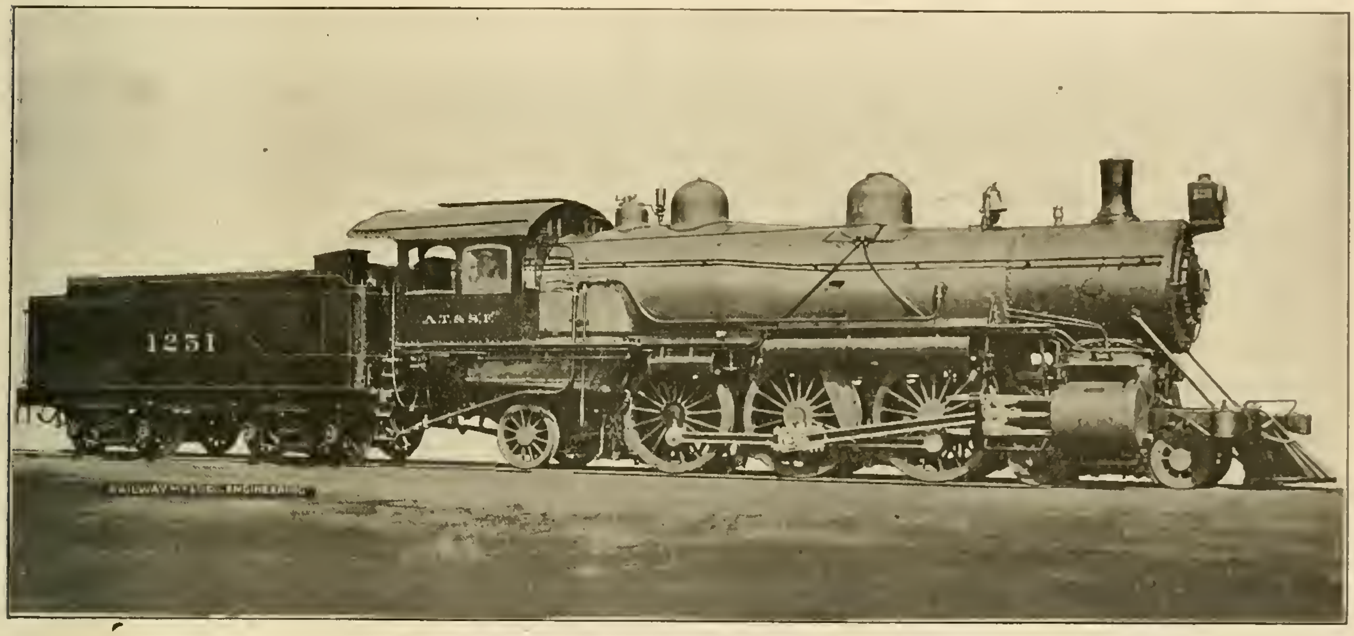
"Skeevers," said he, "I'd a good deal rather put in half an hour a trip cleaning than to shovel coal against that extra notch and an injector that 'forgits.' Just run her like you used to, Skeevers, and I'll keep her tidy."

Locomotive Building.

The American Locomotive Company is running some of its works day and night. The slight falling off in the early part of the year is more than made up already. The Schenectady works are running double time. The Brooks works are on extra time and cannot find skilled workmen in sufficient numbers to go on double time. With a force of 3,000 men the Brooks works are turning out two locomotives a day. A feature of locomotive building is the large number of engines that are being furnished with the Walschaert valve gearing. Cole's Balanced Compound and the steam superheater are growing popular.

Balanced Compound Locomotive.

The demand for increased strength in locomotives for passenger service has called for the introduction of Baldwin's 4-6-2 type of balanced compound locomotives into the service of the Atchison, Topeka & Santa Fe Railroad. The accompanying illustration shows the general appearance of this new and powerful type of passenger engine which is rapidly coming into favor. This class of locomotive was exhibited at the convention of the American Railway Master Mechanics' Association, at Manhattan Beach last June, and it was confidently predicted that it would admirably meet the growing requirements of railway passenger traffic. Since then exhaustive tests of this type of engine have been made, and the reports show that it possesses many decided advantages. It uses from twenty to twenty-five per cent. less steam per indicated horse power, consequently has a low water rate and uses much less coal than the simple engines.



4-6-2 FOR THE ATCHISON, TOPEKA & SANTA FE.
Alfred Lovell, Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

The low water rate and larger boiler give this engine a higher horse power which is needed at high speed and it has been demonstrated that it combines high speed with great reserve capacity, which is very necessary on railways where additional cars are sometimes an absolute necessity.

The balancing of this type of locomotive is maintained by the exact distribution of the cranks and the loading of the wheels, as when the piston of the low pressure cylinder, as seen in the illustration, is in the middle of the stroke, with the main crank pin at the bottom, the high pressure piston on the same side with rod attached to a crank on the front driving axle inside the frames is on the top, while at the left side of the engine the cranks are on the front and back centers at opposite ends from each other.

The low pressure cylinders are 28 ins. by 28 ins., while the high pressure cylinders are 17 ins. by 28 ins., the valves being of the balanced piston type. The boiler is of the wagon top variety with a diameter at the front end of 70 ins. The boiler is radial stayed and adapted to a working pressure of 220 lbs. The fire box is 108 ins. long and 71¼ ins. wide, with depth at the back of 68¼ ins., sloping downwards to 78¾ ins. in front. The fire box is fitted with oil fuel attachments. The flues are of No. 11 wire gauge iron, and are 2¼ ins. diameter, 290 in number and 20 ft. in length. The water space at the sides is 5 ins. in front, 4½ ins. at the sides, and back 4 ins. The total heating surface amounts to 3,595 sq. ft.

The driving wheels are 73 ins. in diameter, with main journals 11 ins. by 10 ins., the others are 9 ins. by 12 ins. The front truck wheels are 31¼ ins. in diameter with journals 6 ins. by 10 ins., while the back truck wheels have a diameter of 43 ins. with journals 7½ ins. by 12 ins. The tank has a capacity of 8,500 gallons of water and also a compartment for 3,300 gallons of oil, and is carried on two arch bar trucks with wheels of 43 ins. diameter, and journals 7½ ins. by 12 ins.

The tractive power of this engine approaches 33,000 lbs., with a co-efficient of adhesion of 4.6. Some of the other dimensions of this engine are as follows:

Boiler—Thickness of sheets, 21/32, ¾ and 25/32 ins.; fire box sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; and tube, sheet, ½ in.

Wheel Base—Driving, 13 ft. 8 ins.; rigid, 13 ft. 8 ins.; total engine, 34 ft.; total wheel base of engine and tender, 66 ft. 1½ ins.

Weight—On driving wheels, 151,900 lbs.; on front truck, 35,800 lbs.; on back truck, 39,800 lbs.; total engine, 226,700 lbs.; total engine and tender, 402,783 lbs.

Apprentice Machinists Ancient and Modern.

BY JAMES KENNEDY.

In my earlier years apprentice machinists, generally speaking, were so completely left to themselves that it is surprising how they managed to acquire even a superficial knowledge of their trade. Most machinists began to learn their trade after they had graduated as journeymen. It was hard knocks that taught them then. The congratulations which they received from their friends on the completion of their apprenticeships were a hollow mockery. The pathos of the situation deepened on receiving their discharge about the same time that they received the congratulations, and they became homeless outcasts. After they had wandered to and fro over the face of the earth, like Noah's pigeon, finding no place to set the soles of their feet, and crawled, like quadrupeds, in slimy engine pits, and stood on their heads facing up old-fashioned throttle valves in narrow domes, they gradually came to their feet and began to know a thing or two, and eventually settled down fairly useful hands at some place generally far remote from the scenes of their careless childhood and still more careless apprenticehood. The struggle for existence did not, as a rule, sweeten their tempers. The vanity of human life seemed to sit heavily on them. They had their revenges by allowing the embryo machinists among whom they lived and moved and had their troublous being to look out for themselves. Nobody had taught them anything, and they gave about as much as they got; and so generation succeeded generation, and the apprentice found that the mysteries of his craft was something akin to the secrets of Freemasonry—they were not to be spoken of even in a whisper. The mysteries enshrouding the laying out of work, the fine finishing of the polished parts, and the setting of valves was something awful. An ordinary apprentice was not even allowed to look upon the latter operation with unanointed eyes. He must needs confine himself to the humbler but more laborious operations of reaming or tapping holes, or carrying heavy weights from place to place like a malefactor doing "stunts" for penal offences.

We live in a more enlightened age and knowledge is cheaper now. The mighty engine of a free press has shed its luminous light into the darkest corners of the earth. Illustrated magazines, correspondence schools and colleges have sprung up and the sunshine of truth is streaming in everywhere. Many railroad and other machine shops have adopted a systematic course of instruction through which the apprentice has to pass, and a certain period of time must be given to each of the sub-divisions, into which his course of instruction is divided.

This method, under competent instructors, is calculated to produce a better class of mechanics, and manifestations of the result is being felt in the perfection of workmanship exhibited in the great bulk of the modern machinist's work.

These thoughts suggested themselves by a visit made last month to the shops of the Central Railroad of New Jersey, at Elizabethport, N. J. Mr. W. McIntosh, the Superintendent of Motive Power, has formulated an admirable system of instruction there which is being carried into effect under the skilled direction of Mr. G. L. Van Doren, the superintendent of the works. Reports of the progress of the apprentices, of whom there are over sixty, are made regularly. Efficiency and rapid progress are properly encouraged, while dulness and carelessness are induced to bethink and bestir themselves. In addition to the regular routine of mechanical work, a school has been established where mechanical drawing, a system of theoretical and applied mechanics, especially devoted to the mechanical appliances used in railway and locomotive engineering, is taught. The apprentices are divided into three classes, and certain days are allotted for each class, an hour and a half for each class each week being about the time allowed for such instruction. Mr. G. W. Rink, the Mechanical Engineer, is chief instructor and arranges the details of the lessons and reports the individual progress of the scholars. The attendance is compulsory as the classes meet during the company's time, the company furnishing the rooms and necessary equipment, with the exception of drawing tools, with which the apprentices are expected to provide themselves.

This excellent method is worthy of the imitation of other railroad shops and it is to be hoped that all of our large machine shops will follow the fine example of the Central Railroad of New Jersey. The difficulty in getting young men to attend technical schools in the evening has been abundantly demonstrated, and in communities where the apprentices are living far apart from each other, the physical difficulties are often insurmountable. The wisdom of age cannot be forced into the mind of youth, and while there are a thoughtful few who reach out and through difficulty and self-denial grasp at and sometimes obtain a higher education, the method adopted at the railway shops at Elizabethport is the best provision that has come to our knowledge of bringing a close and systematic study of the mechanical arts used in the construction and repair of railroad machinery within the reach of every one. Doubtless the improved ability and earnest work of the apprentices so instructed will more than repay the outlay of the company whose generous concern for the welfare of the future mechanic cannot be overpraised or overestimated.

Characteristics of Officials.

In a paper by Mr. J. D. Tyter, presented to the New England Railroad Club on the Work of a Yardmaster, the proper characteristics of a good yardmaster are so well described that they fit very well for all officials. Mr. Tyter said:

"The yardmaster should be a man of the keenest executive ability, conversant with yard work, with tact to manage men; he must be ambitious, energetic, trustworthy, not only demanding respect and obedience from subordinates, but coveting their good will, and with these and the support of his superiors, he will accomplish results and the hardest tasks will come easy to him.

"The character of the man selected for preferment should not be lost sight of, for to properly command his work he must have and retain the respect of all under him. He cannot be a hail-fellow-well-met and place himself in compromising situations and expect to have those under him give full and loyal support to his orders."

While a large number of railway magnates were visiting at Portland, Ore., a smashup of two freight trains occurred, whereby a couple of dozen of carloads of coal were mixed with an equal number laden with wheat. A deep gulch near the track was nearly filled with the remains. Fortunately, no one was hurt.

The Great North of Scotland Railway Company, which have lines traversing some sparcely settled regions, have been using motor cars to some extent and expect to greatly increase the service of such vehicles.

The shortage in cars has seriously affected the saw mills in the Northwest. The present demand for lumber is phenomenal, and the means of shipping it is extremely inadequate. The flour mills are better off in the matter of cars than the lumber industry, which is threatened with stoppage.

Walschaert Valve Gear.

BY MAX PFANDER.

This kind of locomotive gear was designed and patented by Mr. Walschaert, in Belgium, in the year 1844; but it has been applied more frequently only since 1860. At present its successful application on nearly all railroads of the European Continent is a fact, and some remarkable points of superiority to other locomotive gears have led also to its entry into American locomotive practice.

The diagram of a Walschaert gear is shown in Fig. 1, the position represented by dark lines being an arbitrary one. The dotted lines show its position when the main crank is on the dead centers (A_1A_2).

In the ordinary Stephenson link motion the movement of the valve is a combination of two movements, produced by two eccentrics and eccentric rods. The combination is effectuated by the curved link. Even so, the Walschaert gear can easily be decomposed into two systems of motions, one of which is produced by the eccentric E (Fig. 1). The other one is indirectly practiced by the main crank itself. For that purpose the crosshead B (Fig. 1) is fitted with a lever, b, which, by means of a link, c, moves the combination lever d to and fro, the stroke being equal to the piston stroke. The top end of this combination lever d is directly jointed to the valve stem. If we consider the point F transitorily as a fixed fulcrum, it will be seen that the valve, solid with the valve stem, is moved in a direction opposite to that of the piston. As in this group of moved levers is no alteration rendered possible, its motion will be the same for all cut-offs.

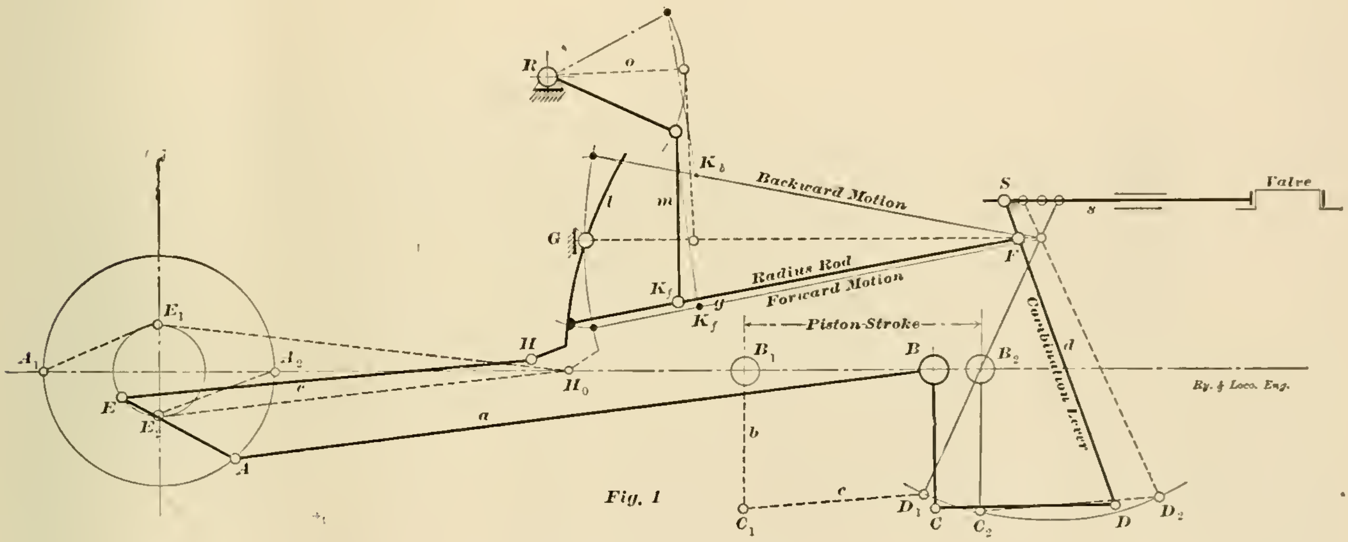
The other group of levers, as already mentioned above, is moved by the eccentric E, which is connected to the curved link l by the eccentric rod e. The link, oscillating around a fixed fulcrum G, drives on the radius rod g. The front end of this rod is jointed to the fulcrum F of the combination lever d. By this way the joint, S, of the valve stem, swinging around F, receives a further movement by the alternating motion of the fulcrum F itself. Thus the combination lever d, properly spoken, takes the place of the link in the Stephenson motion, uniting two separate motions into one.

The gear is rendered reversible by the link l, which, according to the shifting of the link block down or up, reverses the movement of the radius rod g. The suspension of this rod is made in the ordinary way by a lifting link, m, connected to the reverse shaft lever o. The curve of the link l is an arc of a circle having the length of the radius rod as its radius.

This being a short explanation of the different levers, we will now proceed to a closer investigation of the motion. In all correctly designed gears the mid-position of the valve ought to be the same for all cut-offs; that is, equal lead and equal pre-exhaust at head and crank end, provided that the valve has same outside lap and same inside lap on both sides. Let us consider the gear with the main crank in either dead center, as holding two particular and opposite positions. Fig. 2 shows the combination lever d for these two positions. The inclination from the vertical line is on both sides the same; therefore the vertical line is at the same time a center position for the combination lever, and the condition as to equal deviation of the valve towards both sides is fulfilled. The fulcrums F_1 and F_2 coincide with F_0. This coincidence of F_1 and F_2 in the dead center positions of the main crank leads to the condition that the working point, H, of the link must also return to the same place for position E_1 and E_2 of the eccentric; for these positions of the eccentric, which is placed at right angles to the main crank, are respective positions, when the main crank is in dead centers. Consequently the coincidence point H_0 (Fig. 3) must be on the horizontal line through O.

As shown in Fig. 2, that $S_1S_0=S_2S_0$, there ought to exist the equation $H_1H_0=H_2H_0$ (Fig. 3), or the deviation of the link shall be the same on both sides, if we wish to perform the condition of equal valve deviation at head and crank side. Furthermore, F_1 and F_2 and F_0 is the real center of the link curve, with its working point in H_0, as we stated that the radius rod length is equal to the radius.

Now, it is obvious that in these dead center positions the link block can be shifted down or up without moving the valve. The consequence is a constant lead for all cut-offs.



WALSCHAERT VALVE MOTION.

VALVE-SETTING.

The reader knows that the valve, when moving from its mid-position to the point where the piston will be in either dead center, makes a way equal to its outside lap plus the lead. At midgear, if the link block is placed at the fixed link fulcrum G (Fig. 1), the fulcrum F does not move horizontally; hence exists the equation:

$$S_1S_0=S_2S_0=\text{outside lap}+\text{lead}.$$

This statement directly allows to set the valve. The point S_0, being on the vertical line through F_0 (Fig. 2), is determined by the combination lever, its moving link and the crosshead lever. How this group of levers is to be chosen is shown later. The center position of the valve determined by the valve seat is also known. Thus the length of the valve stem for a correctly placed valve can be calculated.

As to the valve setting in the shops, the main crank is to be put at either dead center; then the valve must be placed so that it has just opened the admission port by the amount of the lead; that, of course, is given.

We have supposed that there is the same lead at head and crank end; but this condition is not an imperative one. Generally the closer testing of a new design of the gear for all desired cut-offs will develop that getting a difference in the lead of both sides is not desirable.

TESTING THE GEAR.

Undoubtedly the best manner of testing will be an investigation by means of an adjustable wooden model, if possible in full size. Paper generally is not stiff enough, and leads to inexactness of the movements of the levers, links and valve. A wooden adjustable model is well adapted to determine the influence of each member of the gear. The important phases, as these are: lead, port openings, admission, expansion, pre-exhaust, duration of exhaust, compression, are likely to be compared in tables. The most important phase, of course, is the admission, and the test shall just show whether the admission is the same at head and crank end, in backward and forward motion, for all cut-offs or for those which will generally be used on the locomotive to be fitted with the tested gear. There will generally be a difference in the admission at the head and crank end for the same cut-off. Then the eventually necessary changes are to be performed, and will finally lead to a most perfect steam distribution. In these changes may be included a slight difference in the lead on both sides. But this does not affect the manner of valve-setting, as finally a fixed lead always is given. Moreover, it may be directly stated here that it is not advantageous to have different leads at head and crank end.

DESIGNING A NEW GEAR.

The better the knowledge of a designer is about the influence of the important members of a gear, the more perfect will be found the steam distribution in testing the design. Even that investigation on a model may become dispensable under particularly favorable circumstances.

Concerning the transmission of the crosshead motion, the crosshead link shall be made sufficiently long as to transmit the crosshead motion as exactly as possible. The same remark suits for the combination lever, as to have the angle of deviation not too wide (not over 30 degrees), and that there is distance enough between F and S to place a good joint for the radius rod. The dimensions of the crosshead lever and the crosshead link are generally limited by the distance between the front end position of the crosshead and the back head of cylinder, as well as the height of cylinders above rail. Fig. 2 shows that the following relation is existing between the piston strokes and S_1S_2, S_1F_1, F_1D_1:

$$\frac{S_1F_1}{F_1D_1} = \frac{S_1S_2}{s} \text{ (Fig. 2).}$$

This equation determines the position of the joint F of the combination lever. That the vertical line through F_0 (Fig. 2) shall be the center position of the combination lever has been mentioned above.

A very important point is the angularity of the eccentric rod, which in many cases is the cause of having unequal travel of the valve towards both sides of its center position, and consequently unequal admission. It can be overcome, as already said, by placing the joint H (Fig. 1) of the link on the horizontal through O, so that the angles of oscillation of the link on both sides are about the same. If we would not place H on the horizontal line through O, it is evident that the angle of the main crank A and the eccentric E would no more be a right angle, as the front end of the eccentric rod must be placed at H_0 for the positions E_1 and E_2 of the eccentric. The eccentric rod will often become very short by these conditions, but it is better to have a short eccentric rod than a too short radius rod. The angles of vibration of the link generally do not exceed 20 degrees or 22 degrees, because the slip of the link block would quickly increase

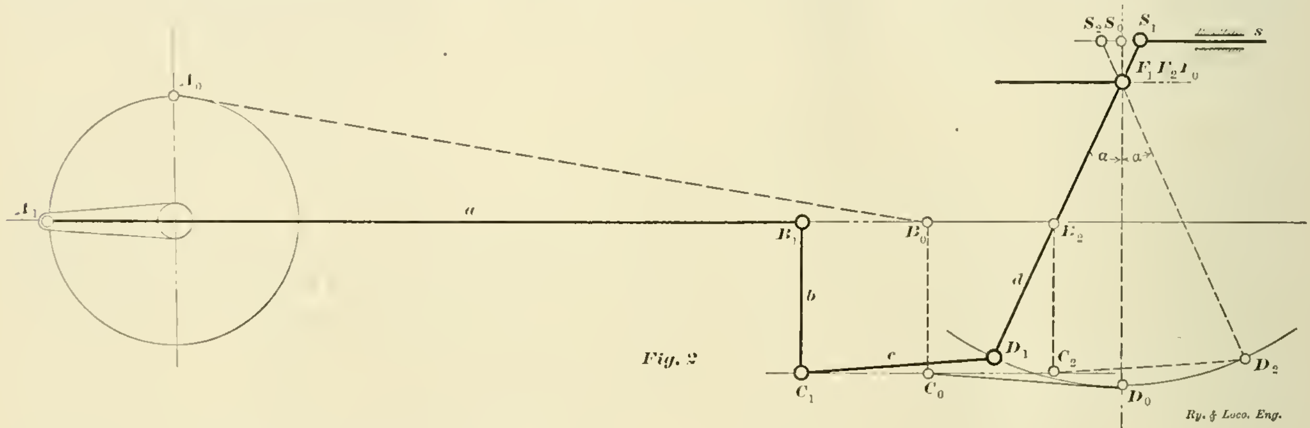


Fig. 2

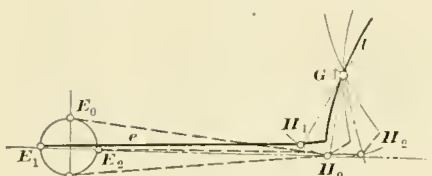


Fig. 3

Ry. & Loco. E...

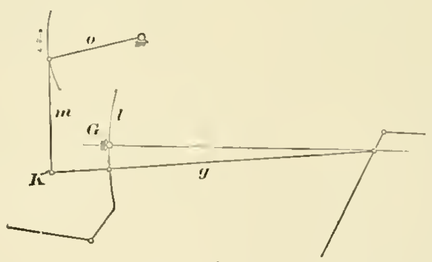


Fig. 4

Ry. & Loco. Eng.

to an undesirable degree of movement. The choice of the length of the link obviously depends upon the horizontal travel of the link block for the desired largest cut-off; this travel is to be determined best by the way of trying on the model.

Closely connected with the choice of the angles of vibration of the link is that of the eccentric radius, which varies about from one-half to one-third of that of the main crank. As this gear mostly is an outside gear, the eccentric construction leads to a return crank. Thus the big and heavy eccentric with eccentric straps can be avoided.

In the considered example, as nearly in all designs of a Walschaert gear, the fulcrum G of the link is placed at the same height above the center line of wheels as the fulcrum F of the combination lever. This design has the superiority of giving the radius rod deviations symmetrical to its horizontal movement to and fro for the different cut-offs.

Finally, as to the suspension of the radius rod, the best acceptable radius and position of the arc of circle drawn by the reverse lever o will be found by experiment. However, it can be said that the position of the suspension link, being also of sufficient length, should be about at right angles to that of the radius rod, for the most used cut-offs, in order to reduce the slip of the link block as much as possible. Theoretically, the arc of the reverse lever would be a curve turning the concave side towards the cylinder; but it would be difficult to find a place for the reverse shaft in the neighborhood of the cylinders. This place of the reverse shaft is always more or less determined by other considerations, as wheels, frame, etc., that will often force to put it into the neighborhood of the link. Then the form of the reverse lever arc can lead to a reverse lever at the back of the reverse shaft, and the bottom end of the lifting link *K* (Fig. 4) would be jointed to the radius rod at the back of the link, the whole radius rod being, in this case, longer than the radius of the link curve.

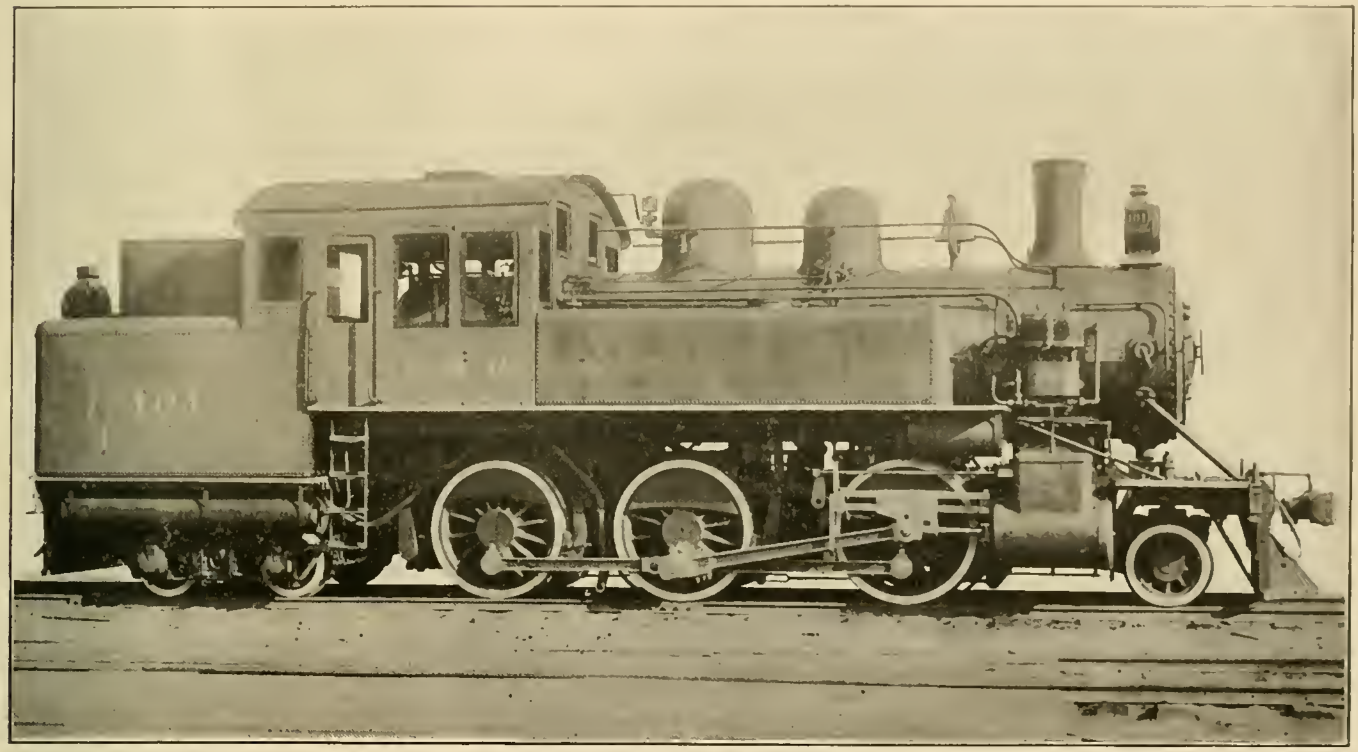
Concluding this article, an enumeration of the essential advantages of the Walschaert gear, compared to the ordinary link motion, may be welcome:

1. Constant lead for all cut-offs.
2. A regular steam distribution.
3. No lateral twisting moments, as all parts are in the same vertical plane.
4. Small amount of weight.
5. Accessibility of all members, as outside gear.
6. Nearly no influence of the spring vibrations of the locomotive, as the motions in this gear are all at right angles to the play of the springs.

Finally, I would direct the attention to the consideration that this Walschaert gear is well adapted to a valve placed on the top of the cylinder, and by no means affects the construction of American locomotive cylinders.

Panama Canal Engines.

Last month we referred to the very large order which had been given to the American Locomotive Company for a class of engines to be used in the construction of the Panama canal. They are of the 2-6-4 type, and are tank engines in the sense that they have two water receptacles on each side of the boiler, as well as one surrounding the fuel space at the back. The engines are specially designed for the particular work they will have to do on the Isthmus, and as there will be one hundred and forty-four of them built in all, the Panama Railroad will certainly be standard as far as its motive power is concerned. The Schenectady shops of the locomotive company are handling the order.



J. C. Baker, Master Mechanic. ENGINE FOR PANAMA RAILROAD. American Locomotive Company, Builders.

The engines are simple, with cylinders 19x26 ins., and driving wheels 54 ins. in diameter, and when working full stroke on the level these engines have a calculated tractive power of 26,590 lbs. The gauge of the road is 5 ft. The center or main pair of drivers are not flanged. The valves are of the Richardson balanced pattern actuated by ordinary indirect valve motion, the link of which is made with a 54 in. radius. The leading drivers and the pony truck wheels are equalized together, and the main and rear drivers are equalized together. The driving springs used all through are composed of 19 leaves 4x¾ ins. with a spread through centers of hangers of 34 ins.

The wheel base of the engine is 32 ft. 8 ins. in all, 13 ft. 2 ins. being the rigid wheel base. The weight of the whole machine in working order is 183,500 lbs., while the adhesive weight is 124,000 lbs., leaving only 59,500 lbs. distributed on the pony wheels and the truck at the back. These weights are taken with fuel and water load, three-quarters of full amount. The capacity of the three water tanks taken together is 3,700 U. S. gallons, and the fuel carried is 5 tons. The back tank is connected with each of the others, and there is a filling manhole on each of the side tanks and one at the rear. The tops of all the tanks are level, though the rear one is the deepest and from the underside of it the injector supply pipes run. The fuel space is in the center of the back tank, but has on top a sort of extended opening or hopper, which permits soft coal, which the engines burn, to be conveyed to the fuel space below. This hopper, if so it may be called, while high and long, is narrow, and does not obstruct the rear view of the men in the cab, which is important considering that these engines are intended to work backward as much as forward.

The boiler is a straight top one, made with two courses in the shell, the smaller being 62⅛ ins. diameter outside. A pressure of 130 lbs. of steam to the square inch is carried. The fire box is narrow in the sense that its outside sheets come flush with the outside of the frames. The actual figures are: length, 90 3/16 ins. by 41¾ ins. wide, giving a grate area of 26.2 sq. ft. The heating surface is 1,497 sq. ft. in all, made up of 125.1 sq. ft. in the fire box and 1,372.7 sq. ft. in the tubes. These latter are 320 in number and are each 12 ft. long. The crown sheet staying is radial, and there is a 30 in. dome carried near the back of the second barrel sheet.

The engines, as will be seen from our illustration, are neat and compact in appearance and have been designed with a view to convenience in repairs and of handiness in operation. They are to be used on the main line for steam shovel work. The canal itself will be 46⅓ miles long. The width at the bottom will be 75 ft. and at the top it will be 124 ft. wide. The depth of water in the canal will be 30 ft. The digging of this immense ditch is a great piece of work and the hauling of the excavated material will keep these engines busy for some years to come. A few of the principal dimensions of these Panama engines are as follows:

Axles—Driving journals, main, 5½x10 ins.; others, 8½x10 ins.; engine truck journals, diameter, 5½ ins.; length, 9 ins.; trailing truck journals, diameter, 5 ins.; length 9 ins.
Fire Box—Thickness of crown, ⅜ in.; tube, ½ in.; sides, ⅜ in.; back, 5/16 in.; water space, front, 4 ins.; sides, 3½ ins.; back, 3 ins.
Tubes—Material, char. iron.; diameter, 2 ins.; gauge No. 11 B. W. G.
Air Pump—Duplex No. 2 Right side; reservoir, 2 ft. 16 ins. by 108 ins.
Piston Rod—Diameter, 3¼ ins.
Valves—Travel, 5½ ins.; steam lap, ⅞ in.; ex. lap., line and line inside.
Setting—1/16 in. lead in full gear F. A. B.
Wheels—Engine truck, diameter, 30 ins.; trailing truck, diameter, 28 ins.

Past and Present.

"Sufficient unto the day is the evil thereof," is an ancient saying that applies to modern conditions. There is evil, and toil, and trouble to spare in modern railroad conditions, but those of us who have borne the burden and heat of the day during ancient railroading conditions can scarcely help envying the comforts bestowed upon modern trainmen. The contrasts were brought vividly home to us on reading a letter from W. H. H. Webster, a retired locomotive engineer, which appeared in the *Locomotive Engineers' Journal.* Here are a few extracts:

"In the early 60's, the boarding houses in Buffalo were very limited, and it was 'first come, first served,' so that an engineer coming in late at night on going to his boarding house would often find every bed occupied and would have to go back to the roundhouse and take the cushions of the seats, lay them on the deck of the engine, and amid the smoke and steam try to get a little sleep, but he would often find the place occupied by his fireman who had found his boarding house full. Well, one day myself, with several other engineers, petitioned the superintendent to order the master mechanic to fit up the upper part of a small building in the yard back of the roundhouse for a bunk room, which was done. A large table was made and a number of chairs and box for each of the engineers. These boxes were exactly like those now used by the undertakers, only they had hinges on the lids and were locked with a padlock, with the engineer's name on the lid. We furnished our own blankets and a pillow. In coming in late at night and climbing the rough stairs which were on the outside of the building, we would enter as quietly as possible, so as not to disturb those already asleep, and lighting the old oil lamp, would unlock our box and prepare to turn in for a few hours' sleep, but before doing so would look into the open boxes to see who was in them. It was an uncanny sight and recalled the description of the immortal Burns in his Tam O'Shanter, of 'Alloway's Auld Haunted Kirk,' where

'Coffins stood around like open presses,
That showed the dead in their last dresses.'

"The engineer to be called for an early run in the morning, chalked the time of his run on the lid of his box so that the callboy would not awaken the wrong man, who would resent being disturbed by waking up the rest of the sleepers.

"Many a time after doubling the road on freight, I have come in at 1 or 2 in the morning and crawled into the little nest in my box, tired almost to death and covered with smoke and sawdust, for we burnt wood in those days, and nature's sweet restoratives would knit up the raveled sleeve of care and weight my eyelids down and steep my senses in forgetfulness, and my sleep would be as sound as it will ever be after I am dead. But let us now compare the difference between that bunk room and the fine Y. M. C. A. building in the same city. They say corporations have no souls. Well, if they haven't themselves, they have helped to save some other souls, and the Y. M. C. A. is working on that line. The railroad employee need no longer sleep on the deck of his engine or his caboose. He finds after returning from a long, hard run a beautiful, warm building, with marble washbowls and a marble bathtub, and a soft bed with a quiet room all to himself, and in the morning he finds a fine breakfast in a clean, beautifully lighted dining room; and after breakfast, if time will permit, he can read the morning papers in a cozy reading room or enjoy a smoke in the smoking room. The building is fitted up with the elegance of a first-class club, and all this with a cost far less than that in the days of the dilapidated boarding houses and beer saloons."

Big Engine.

Superintendent of Motive Power Kilpatrick, of the Delaware, Lackawanna & Western Railroad, has completed plans for the construction of the largest locomotive ever built. It is said that the big Mallet articulated compound of the Baltimore & Ohio Railroad will look small when this one comes along. It is being built for the special purpose of hauling long freight trains over the mountains. At present two of the largest locomotives are used to haul these trains over the Morris & Essex division of the road.

The Young Men's Christian Association have made a new move in connection with their railroad work at Columbus, Ohio. Instead of merely waiting in the meeting rooms and calling upon sinners to come and be saved, they have their speakers go to the various shops and speak a word in season during meal hours. The leaders of the movement say that this new way of spreading the Gospel is very successful.

When Sam Sloan left college he told his friends that he intended to look about for a few months before he decided to go to work. There were so many opportunities for a young man with a B.A. degree in his pocket that it took careful consideration in making a choice. Six months afterwards I found Sam braking on a freight train. He probably made a wise choice, but he remarked that he took the first job he was really offered.

Mr. Henry F. Shaw, of Boston, well known in railway circles for his devotion to the problem of balancing the reciprocating parts of locomotives, has presented to Purdue University a model locomotive embodying his latest design. The model is constructed on the scale of one inch to the foot and is an excellent piece of work.

When the crops are moving, there is nearly a shortage of railroad freight cars all over the American continent, but scarcity of cars is an expression almost unknown abroad. We find the echo of a similar grievance from far away India. The Chamber of Commerce of Bengal has remonstrated with the Indian Railway authorities on account of the scarcity of railroad cars, saying that at least 3,000 more cars are required. The committee was informed that 2,200 new cars would be ordered.

Early Boilers.

In connection with the discussion as to how the telegraph instrument key has never been improved upon since it was designed by Morse, there are many other industrial appliances that were almost perfected when first introduced. A good example of this is the marine boiler.

The early boilers in seagoing vessels were of what has been called the "box" type; that is, the boiler was a cubical box with a thin shell, the real strength being given by braces running in three directions. When surface condensation had made higher pressures possible, it was soon found that the multiplicity of braces, as pressures were increased, made an impossible condition of affairs, and this led to the design of the cylindrical boiler whose shell was self-bracing and left the only braces those needed for the heads and flat surfaces. This boiler so thoroughly met the conditions arising that it has remained the favorite even up to the present day. At one time an effort was made to save room by making the boiler elliptical, but this was soon found to be unsatisfactory and impracticable and was abandoned after only a few examples.

The earliest cylindrical boilers were single ended with two furnaces, but with the advent of reliable mild steel the diameters were increased and the boiler was made double ended, with upper ends rounded to save bracing, so that the largest cylindrical boilers today have as many as eight furnaces, four in each end in pairs; that is, the two furnaces at each end on the same side of a vertical diameter have a common combustion chamber. The saving in weight due to the double ended boiler is evident at once and also the reduction in the feeding apparatus required.

Notwithstanding the advent of the water tube boiler, the cylindrical boiler still remains the favorite for the merchant service, and has been used for pressures as high as 220 lbs., even in the largest sizes on such vessels as the "Kaiser Wilhelm." The highest recorded pressure is 225 pounds on the Inchdune.

An Italian inventor has patented a machine for printing railway tickets. The idea is to print the ticket as it is needed, a manifold impression making the necessary record. It seems a feasible scheme, but general passenger agents might find many flaws in such a simple arrangement.

New York Central Inspection Engine.

The New York Central people have recently received from the Schenectady Locomotive Works a new inspection engine which is attracting a great deal of attention. The general appearance of the engine can be judged from the annexed engraving, which we received from "Railroad Men," 361 Madison avenue, New York. The cylinders of the engine are 15x20 ins., driving wheels 62 ins. diameter, heating surface 1,045 sq. ft., which represents a fairly powerful engine having tractive power of 72 lbs. for every pound of effective pressure in the cylinders.

Slow in Starting the Tools.

It is very unusual to find a railroad repair shop so lavishly provided with machine tools and manufacturing appliances that they can be left idle for a long period. This extraordinary thing happens sometimes, however. Mr. M. E. Manchester speaking at the Master Mechanics' Convention, related an instance that will strike most railroad men as curious. He remarked: "Three years ago I had occasion to purchase quite a number of tools, and there were some of them that I was not personally well qualified to judge of, not having had personal experience with them. I sent out some experts to look for information in that direction, and I naturally directed them toward several new shops, that is, shops that had been in operation as new shops from one to two years. Among the tools that I refer to was a hydraulic plant with a riveting arrangement in a boiler plant. The report that I received from one shop that had been in operation for two years was that they had a hydraulic plant of a certain make, it was installed in the shop in such and such a manner, and appeared to be a very well arranged plant and tools, but they were unfortunate in getting any information as to what the tools could do, or would do, if in actual operation, as that plant had been 'in use only two years and they had not used it yet.'"

INSPECTION LOCOMOTIVE FOR THE NEW YORK CENTRAL LINES.

Steel Tie for Railroad Track.

A very simple steel railroad cross tie has been devised by the Carnegie Steel Company. It is, in fact, an I-beam with top and bottom flanges of unequal width. The tie is 8 ft. 6 ins. long, and stands 5½ ins. high. The top flange upon which the rail rests is 4½ ins. wide, and the bottom flange is 8 ins. wide, thus giving a wide area for the tie to "stand on."

In the top flange there are ¾ in. holes drilled to receive the bolts which, in the case of steel ties, take the place of spikes. These holes are staggered and allow for an adjustment of the rail to gauge. A clip sloped to suit the bottom flange of the rail is used with these bolts, and an adjustment of rails to gauge may also be had by alternating the size of the clips.

At a point 6 ins. from each end of the tie, there is a small area in the bottom flange about 1½ ins. square, which is depressed to a distance of about ½ or ⅝ of an inch. There are four depressions in all, two on each side of the central web. This alters the otherwise unbrokenly smooth surface of the bottom flange and forms, as it were, four small anchors which, when embedded in the ballast, have a tendency to prevent any end movement of the tie.

A Long Electric Railway.

A contract has recently been signed for the construction of an electric railway in Washington, which will be 146 miles long, the longest electric railway in the world. The organization is controlled by a number of Spokane capitalists, of whom J. P. Graves is the president. The system for electrifying the line is the Westinghouse single phase alternating current system, the same as the New York, New Haven & Hartford Railroad is going to adopt as part of its system, and for which purpose it recently contracted with the Westinghouse Company for twenty-five locomotives.

Power for operating the road will be

obtained from the Washington Water Power Company, which has harnessed the waters of the Spokane river, and the electric current will be transmitted at a pressure of 4,000 volts to the power station of the railroad company. From this station electric current will be transmitted along the line of the track at the enormous pressure of 50,000 volts to fifteen transformer sub-stations located along the line. In these stations the current will be reduced for the operation of the motors on the cars.

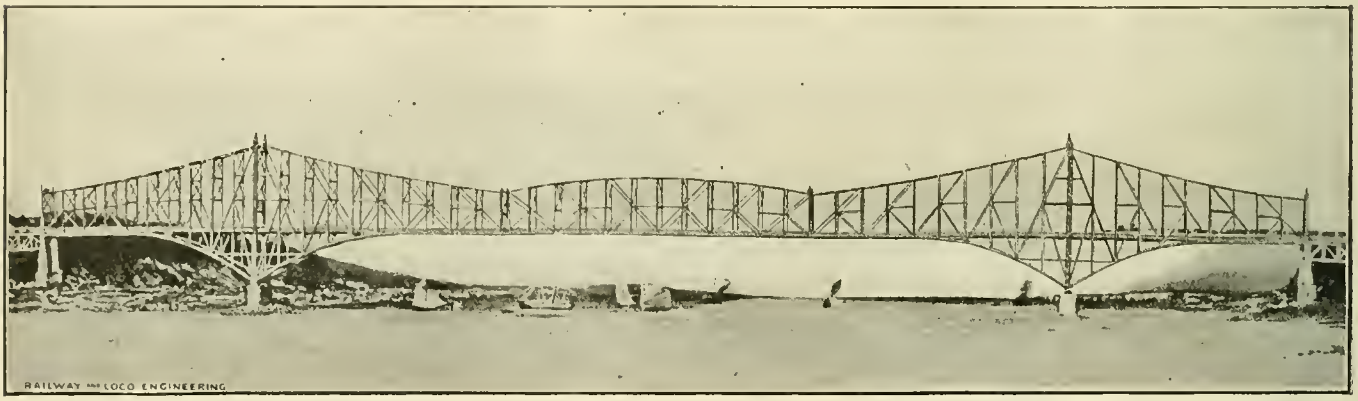
New Bridge Across the St. Lawrence.

The Quebec Bridge & Railway Company are having a bridge built across the St. Lawrence river about six miles above Quebec. The bridge is of the cantilever type and the place selected is at a point where the river narrows to about 2,000 ft. at low water. From this point up the stream to Montreal, a distance of 165 miles, there is no other bridge now existing, while below Quebec the river widens so rapidly that the bridging of the river below that point is very improbable. When the new bridge is finished, therefore, it will be the only bridge between Montreal and the sea, a distance of nearly 1,000 miles.

The central span of the bridge, which extends almost from bank to bank of the river, is 1,800 ft. in width, with a central suspended girder of 675 ft. long and 130 ft. deep at the center, while the anchor spans are each 500 ft. wide. The total length of the bridge is 2,800 ft., exclusive of the approach spans, which are each 210 ft. in length. The completed bridge will have a clearance of 150 ft. above high water mark. The great width of span has been made necessary by the depth of the river which deepens rapidly from the banks to a maximum of 200 ft. The tide water rises 15 ft., and the velocity of the current is over 3 miles an hour. The difficulties of construction are augmented by climatic conditions, work having to be suspended during the winter months on account of the intense cold and the shortness of the daylight, which does not exceed five or six hours a day during December and January. In spite of these drawbacks the work is being rapidly advanced and there is every reason to believe that the work will be completed within the time agreed. The work began in April, 1904, and the contract calls for the completion of the work in December, 1908. The Phœnix Bridge Company, of Phœnixville, Pa., to whom the contract for the steel work was awarded, have mastered the difficulties of the situation with wonderful alacrity. Two spans of the superstructure have already been completed in the shops, one of the spans being already at the site where the piers are approaching completion. An elaborate power plant with special machinery has been installed for lifting the heavy trusses, which are continuous from between the two anchors and have upward reactions at two points only. The main trusses are 67 ft. apart and vary in height from 98 ft. to 315 ft. The trusses are connected with pins 12 ins. in thickness; the minor braces and the entire floor system are riveted.

The bridge is designed to connect the New Grand Trunk line and will also connect the Great Northern Railway of Canada, the Quebec & Lake St. John Railway, and the Canadian Pacific Railway on the north side of the river and the Grand Trunk, the Intercolonial and the Quebec Central Railway on the south side. The total cost will approach $4,000,000. The bridge will carry two railroad tracks, two electric street car tracks, two highways and two sidewalks. Some of the pieces used in the construction are of great magnitude. The floor beams are girders 66 ft. in length by 10 ft. deep, and required special cars for their transmission from the works at Phœnixville to the site of the bridge. Work is proceeding at both ends of the bridge, and there are two 60 ton electric traveling cranes of 60 ft. span with 750 ft. runways, besides a special 450 ton steel traveler at work at the anchors. Attached to this traveler are thirty-eight ten ton tackles operated by four special electric hoisting engines. The electricity which drives these hoists is furnished from the Chaudiere Falls power plant, and the hoisting and placing in position of the massive beams proceeds with a degree of exactness not approached in any previous undertaking of a similar kind.

Comparing the new bridge with other bridges, the nearest approach to the Quebec bridge in the length of span occurs in the bridge over the river Forth in Scotland, where there are two spans of 1,710 ft. each, besides two shore arms each 680 ft. in length. This bridge is also built on the cantilever principle. Next in succession in length of span is the new East River bridge at New York, with a span of 1,600 ft. in length, and the Brooklyn bridge, with a span of 1,595 ft. The latter two are suspension bridges, and in point of architectural grace, perhaps, surpass any similar structure.



NEW BRIDGE ACROSS THE ST. LAWRENCE. LONGEST SPAN IN THE WORLD.

The correct German word for subway is "unterirdischeeisenbahn." It is very expressive and the best thing about the name is that the guards do not attempt to shout it as they approach stations.

The purchase of the Rutland Railroad by the New York Central Railroad is the cause of much rejoicing among the people at Malone, where extensive car shops are about to be built at a cost of nearly $200,000. A roundhouse will also be erected at Niagara Falls.

The motor car for the Union Pacific, illustrated in our August number, built from designs furnished by Mr. W. K. McKeen, Jr., is attracting a great deal of attention and is declared to be an unqualified success. The management of the Union Pacific are so well satisfied with the performance of the car that they have ordered two more to be built immediately. The new cars will have engines of 200 h. p.

General Correspondence.

Superheated Steam.

Editor:

It is now understood that the temperature of water may be increased by an increase of pressure; so, conversely stated, an increase of pressure may be obtained by increasing the temperature of the boiler.

A table given below, which is very much abbreviated, may be referred to in order to show the variation of pressure with the temperature. Some other figures are also given which may be useful for reference hereafter. The figures are partly taken from experiments conducted under the direction of Prof. Cecil H. Peabody, of Massachusetts:

PROPERTIES OF SATURATED STEAM.

Press. by Gauge (above vacuum) in lbs. per sq. in.	Temp in deg. Fahrenheit.	Volume of 1 lb. Steam in cu. ft.	Density, or Weight per cu. ft.
0	212	26.36	.03794
50.3	297.8	6.53	.1533
100.3	337.8	3.82	.2617
150.3	365.7	2.72	.3671
200.3	387.7	2.12	.4707
245.3	404.4	1.76	.5686
275.3	414.2	1.585	.6308
335.3	432.0	1.325	.7545
435.3	444.9	1.167	.8572
535.3	477.5	.859	1.164
635.3	495.7	.731	1.368
735.3	512.1	.636	1.572
835.3	526.8	.563	1.776
935.3	540.3	.505	1.980
985.3	546.8	.480	2.082

The pressure of the atmosphere at sea level is taken to be 14.7 lbs. per sq. in.; therefore the absolute pressure may be found by adding 14.7 to the gauge reading; *i. e.*, at zero, gauge pressure, the absolute pressure is 14.7 lbs. per sq. in.; at 985.3, gauge pressure, the absolute pressure is 1,000 lbs. per sq. in. It is seen here, then, why the table gives the gauge pressure to 0.3 lbs. per in.; *i. e.*, because the table was prepared to give the figures of data for even pounds pressure, absolute; and when 14.7 is added to the above given gauge readings the result is an even number.

It is interesting to note how the volume decreases as the temperature and pressure increase; also that the volume varies inversely as the density. This is true, as a matter of course, and is explained by Marriotte's or Boyle's law.

To more thoroughly understand the nature of superheated steam, it may be well to define some terms met with in the use of steam in general practice at present, for the general use of superheated steam is in advance of present-day practice, although its use is becoming much more common every day. This is not intended to give the impression that superheated steam is a new discovery, for it has been known and used, although to a very limited extent, for many years.

We have just discussed, in a brief way, the relation existing between the temperature of steam and its pressure, and explained that when steam is generated in contact with the water, as in the ordinary cylindrical boiler, the temperature varies directly as the pressure; *i. e.*, as one rises the other rises, and vice versa. When steam is so generated we have what is known as saturated steam, and it may be either wet or dry. When wet it contains perceptible moisture in the form of mist or spray, but dry steam contains no moisture, and may be either saturated or superheated. When steam contains not more than 3 per cent. of moisture it may be termed commercially "dry."

To answer a question that is frequently raised, it might be well to state here that saturated steam has the same temperature as the water with which it is in contact. From wet steam, then, we advance to dry steam, but either one might be saturated steam; and from saturated steam we may advance to superheated steam; but dry steam may evidently be either saturated or superheated. To define superheated steam, then, we may say that it is steam which is not in contact with water and which has a temperature higher than that normally due to the pressure under which it exists. In other words, for any given pressure of saturated steam there is a corresponding temperature, and if steam under that pressure may be conducted away from the water from which it was generated, and raised to a higher temperature while still under the same pressure, it is then what is called superheated steam. In passing, it might be remarked that in a certain style of vertical boiler the fire tubes pass through the steam space, and it is claimed by some that the steam is superheated, but this can hardly be true, for the steam is still in contact with the water from which it was generated, and the salient idea to bear in mind is that "steam cannot be superheated when it is in contact with water."

VIEW OF KICKING HORSE CANYON, CANADIAN PACIFIC RAILWAY, TAKEN FROM CAR WINDOW WITH TRAIN IN MOTION.

Dr. Seimens found that when steam at 212° was heated separate from water it increased rapidly in volume up to 230°, and after that it expanded practically uniformly, as if it were a permanent gas. So it is that superheated steam, having a temperature considerably above that of saturated steam at the same pressure, follows very nearly the laws of perfect gases, and consequently it is called "gaseous steam" or "steam gas." But when the temperature is close down to the temperature of saturation, the variation from these laws is too great for accurate calculations to be made.

The specific density of gaseous steam, according to Clark, is 0.622, or very nearly five-eighths that of air of the same temperature and pressure; that is to say, the weight of a cubic foot of gaseous steam is about five-eighths of the weight of a cubic foot of air having the same temperature and pressure. According to Rankine, the weight of a cubic foot of saturated steam varies as the 17th root of the 16th power.

Shifting from the theoretical to the practical considerations of superheated steam, we may answer briefly the question, "Why is superheated steam used?" by saying that it gives a higher efficiency, for the reasons that its volume is greatly increased as compared with saturated steam, there is less leakage (and consequently less waste) past the valves, and, what is of greatest importance, there is obviated the loss due to initial condensation in the cylinders and allowing the engine to work through a greater range of temperature. It should be borne in mind that steam is simply a medium for the transmission of heat, and that water mechanically mixed with steam carries heat away with it without any useful effect, and when water is present in any marked quantity it becomes a source of danger and of serious loss in the engine.

This leads to the question of lubrication in the valves and cylinders. With water present in saturated steam difficulty is frequently experienced by having the lubricant washed away: with superheated steam this condition does not exist. On the contrary, however, steam may be superheated to such an extent as to burn up the oil which is injected to perform the duty of lubrication, and the packings may also be burned out.

According to Dixwell, if superheating is carried high enough to maintain in the cylinder a temperature of 400°, with steam at a pressure of 70 lbs. per sq. in., this is the possible limit of lubrication; but more recent experiments and actual practice show that engines are working with superheated steam at over 500° temperature and pressures of 200 lbs. per sq. in., and even higher. Lubricants which will resist the higher temperatures have been provided, and special improved devices for supplying the lubricant to the valves and cylinders are also provided. As regards the packing for piston rods and valve stems, it is simply a matter of providing a metallic packing having a higher melting point than that used with saturated steam, and mixtures which will meet the requirements are already in successful use.

The whole answer to the question may be condensed into the statement that superheated steam is used because it results in a saving of fuel, and generally fuel is the largest single item of expense, and not infrequently the cost of fuel is much larger than all the operating expenses combined.

In answer to the question when superheated steam may be used, we may say in reply that if it is merely a question of cost (and that is what usually decides), it may be used when the saving in fuel will be greater than the cost of the installation of the superheating accessories and the cost of maintaining the same in an efficient condition. O. K. HARLAN.

Schenectady, N. Y.

Those Two Similar Engines Again.

Editor:

In the August issue of RAILWAY AND LOCOMOTIVE ENGINEERING, you published an article by A. J. Monfee, describing the 20 x 24 in. Birmingham Southern R. R. switch engines, and invite a discussion of the reason why the engine with a boiler pressure of 130 lbs. developed more power than the engine with a pressure of 145 lbs.

The indicator would, if applied to these engines, show any disarrangement of the valves if any existed, and would show the presence of restricted openings and would give the mean effective pressure on the pistons. It is a good thing, but it will not give the draw bar pull, and this is the pull that moves the train.

Taking it for granted that, as Mr. Monfee says, both engines are alike to a T, with exception of boiler pressure and thickness of tires, supposing that the flow of steam from boiler to cylinder is as free in one as the other, it is my opinion that the difference in thickness of tires was what enabled the 130-lb. engine to pull train and the 145-lb. engine not to.

Mr. Monfee does not give diameter of wheels of these engines, but states that the tires on the 145-lb. engine are 3⅛ ins. thick, and the 130-lb. engine tires 1¼ ins. thick.

This would give the 145-lb. engine nearly 4 ins. greater diameter of wheels, and if you figure the tractive power of these engines on that basis, you will find that the power of the 130-lb. engine is about the same as the 145-lb. one. There is a slight difference, but not enough to count.

Now, any engineer knows, or should know, that if we take two engines of the same size, weight, etc., and the same length of stroke, and put driving wheels of a greater diameter on one than on the other, the one with the larger wheel will be a weaker engine, because she will be more apt to slip, and because we lose a certain amount of leverage of driving wheel.

Apply this to the two engines in question. When the engineer of the 145-lb. engine took slack to start train, he opened throttle a certain amount, or, I should say, distance. Now, when a certain point was reached, she slipped and could not pull train. Now with 130-lb. engine and a smaller wheel, which we find gives about the same tractive power, the engineer could open throttle to the point or distance where the larger wheel engine would slip, and a still greater distance before the slipping point was reached on the 130-lb. engine, and with a wider throttle you get a great M. E. P. on pistons, providing, of course, valves and connections are the same, and that reverse lever stands in same notch on both engines.

To sum up, the 130-lb. engine pulled the train and the 145-lb. engine failed, because the former could take more steam to start train without slipping, and she could do this owing to the fact that her drivers are nearly 4 ins. less in diameter than the wheels of the 145-lb. engine. E. C. ALLEN.

Defense of Hollow Staybolts.

Editor:

Failing a few days ago to learn the name of the writer of the ostensible editorial headed: "The Burning of Coal," I turn to that writing, in this, my first opportunity to say for publication:

I do not accuse you of writing it, but in its publication by you, the responsibility is on you; therefore, I claim that the name of the writer should be published in your next issue.

The article is not an academic editorial in the railway or public interest. It is a screen to cover a falsehood. It is a screen to obtain publicity and circulation through RAILWAY AND LOCOMOTIVE ENGINEERING for the falsehood. It is published as an editorial to give the force of editorial opinion to the preintended libel, in the words: "The use of numerous hollow staybolts that ran its course as a fad a few years ago."

The writer of that knew his statement was a falsehood. He knows that "the use of numerous hollow staybolts" is greater than ever. He knows that a new mill of double its former capacity has been erected to make hollow staybolts, not to run hollow staybolts as "a fad." They are, and he knows it, that they are at once the best material and that they save largely in expense by their being hollow, having natural holes through from end to end to give warning without testing when breakage occurs, and they always earn their own cost by conveying oxygen in non-cooling air-let jets to the fire.

The writer of the ostensible editorial is "up against the hollow staybolts more often than against any other." He finds them in use by railways which have been using them for ten or more years, and who are continuing to use them, because they are satisfied, as one of them said to me: "Yes, and I will use them forever, for I have had good satisfaction with the hollow staybolts." And many others have said as much in their own way of expressing themselves.

Are they using them as fads? He insults the motive power men when he says so, and you help him with the use of your columns.

The motive power men may be imposed upon with falsehoods, and may take hold for a time of something they do not see through, but they have been seeing through hollow staybolts for seventeen years, they know their worth, their use is increasing, they are in engines from Canada to Mexico and across two oceans, notwithstanding the entre nous slanders of somewhat similar kind to that libel in your ostensible editorial entitled "The Burning of Coal."

JOHN LIVINGSTONE.

Montreal, Que.

[The statement which has aroused the wrath of our correspondent appeared in a paragraph at the end of our article on "The Burning of Fuel," and reads: "Every man who has run a variety of locomotives can easily understand how large grate area may cause loss of heat. The use of numerous hollow staybolts, that ran its course as a fad a few years ago, ought to be edifying to those who are trying to find out why very large grate area is not satisfactory."

We are afraid that reference is there made to a historical event which some railroad supply men are not familiar with. When our railroads first began using bituminous coal instead of wood, a great many schemes were resorted to for smoke prevention, and among them the use of hollow staybolts that were put in, not in the interest of safety, but to admit air above the fire. At the Master Mechanics' convention in 1877, the use of hollow staybolts was discussed at length. An influential member said: "The proportion of hollow stay area to grate surface should vary with different coals from 1/60 when the fixed carbon is 60 per cent., to 1/50 when the fixed carbon is 55 per cent. . . ."

"We use hydraulic pipe for staybolts with a hole ⅝ in. diameter."

As the railroads extended their experience with coal burning locomotives it was found that arranging for the admission of air through hollow staybolts was wasteful of heat, as there was no means of regulating the supply. The subject was repeatedly discussed at Master Mechanics' conventions and the sentiment against admitting unregulated air to the fire box in that way became widespread. It is safe to say that no locomotive now has staybolts with ⅝ in. hole.

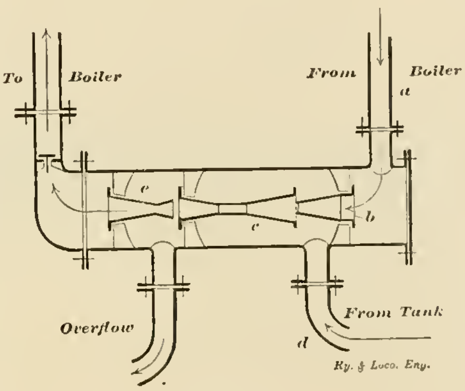
The modern hollow staybolt with a small hole to detect breakage became popular as a measure of safety. It does not admit enough air to complicate the combustion problem. Our noisy correspondent is barking up the wrong tree. —ED.]

Why Does the Injector Work?

Editor:

Every one who has to watch a steam boiler knows how the injector is to be operated and how its interior is constructed; but to conceive how it works is quite a problem for nearly all who have to do with it. They say, "Well, steam under a high pressure drives the water from the tank into the boiler." But they don't consider that this boiler is under the same pressure, which is a great resistance for the entering water having no other energy than that imparted to it by the steam from the same boiler.

Now, let us see how the struggle between steam and water may be explained physically and mathematically: Steam is led into the injector by the tube *a* coming directly from boiler. Here it passes the tubes *b* and *c*, carrying away the air around them, thus causing a high degree of vacuum. As soon as that vacuum begins to be formed cold water enters through the pipe *d* coming from the tank.



INJECTOR.

What will now happen, when steam meets cold water? Nearly an absolute vacuum will be formed, while the water's temperature rises at once in proportion to the quantity of steam it meets with. That heated water now is pulled through the tube *c* by the steam coming from tube *b*, and enters into the tube *e*, while the vacuum gets filled with new water and steam, producing vacuum again.

From tube *e* the water should be pulled on into the boiler; but behind us we have boiler pressure, before us exactly the same one, and the whole resistance of pipes, valves, corners, etc., into the bargain. What is to be done now? Let us resolve in the following way:

When steam comes out of the boiler what amount of work is it doing? Work is equal to power multiplied by way on which it has acted. The power in our case will be found by means of the formula:

$$\frac{3{,}1416 \times d^2}{4} \times p$$

d equals inside diameter of steam pipe *a*, *p* equals pounds per square inch.

For instance: diameter *d* of steam pipe *a* is 1½ in.; boiler pressure *p* equals 200 lbs. per square inch:

$$\text{power} = \frac{3{,}1416 \times d^2}{4} \times p =$$

$$\frac{3{,}1416 \times 1\tfrac{1}{2}^2}{4} \times 200 = 354 \text{ lbs.}$$

The length of the raising steam column is 3 ft.; therefore the work which has been done by the raising steam equals 354 × 3 = 1062 foot lbs.

We see that the work is equal to the volume of the steam column. This should now enter the boiler; but, as we mentioned above, the steam condenses, and the length of the steam column will shorten very much by doing that.

Water being 133.8 = 134 times heavier than steam of 200 lbs. per square inch pressure, the length of the steam column must get 134 times shorter when condensed to water than being steam of boiler pressure. This small quantity of condensed steam, to enter into the boiler, only wants 1-134 of the work it did by leaving it: 1-134 × 1062 = 8 foot lbs.; the rest: 1062 — 8 = 1054 foot lbs., have been consumed by winning the resistance in pipes, valves, etc., drawing the water from the tank, and especially by heating it. To raise the temperature of one cubic foot of water only one degree Fahr. there are needed 48,600 foot lbs.

A good deal of the work stored up in the steam is consumed by giving to itself and to the water an extraordinary speed by which all resistances are winned.

WILHELM WÜSCHER,
Ingeniero Mecanico.

Rosario, Argentina.

Keeps Your Sleeves Dry.

Editor:

Every engineer knows what a moist job it is to couple up a tank-hose after disconnecting it for the purpose of cleaning the strainer. Very few tank valves will shut down perfectly tight; and the leakage, when attempting to connect the hose, is not appreciated by the man who is doing the coupling. Here is a simple remedy: When all ready to couple the hose, start the primer of the injector, when all of the leakage will be drawn into the suction pipe by the strong vacuum so created.

E. W. GREGORY.

Hoffmanville, Md.

Slipping Shut Off.

Editor:

We have a standard 17x24-in. engine, No. 356, which, about a week ago, on a passenger run, after having been shut off for 60 or 80 rods, began spinning its drivers. The engineer observed that the throttle was tightly closed and upon opening the cylinder cocks, could not see or hear steam. Engineer also applied brakes, but that did no good. Finally the wheels stopped spinning, apparently of their own accord. Engine did the same thing on same run, about two months ago, with different engineer, but this time the side rods were badly bent and the engine had to go to shop. In both cases cylinder cocks were opened, but it is said no steam came from them. Will you kindly give me your idea of the cause of the trouble?

Yours very truly,
E. M. Parsons,
Fireman C. & N. W. Ry.

Carnarvon, Iowa.

[There was a lengthy and interesting discussion of this phenomenon in the pages of Railway and Locomotive Engineering last year. The letters from our numerous correspondents can be found by reference to the 1904 index, under the heading which appears over this letter. We refer the writer of the letter and any others interested in the question to page 112 of our March, 1904, issue.—Ed.]

Three Tangents.

Editor:

Any practical railroad man that has served the mechanical department long enough to witness the partial passing of the simple to the "frenzied" locomotive, after reading the paragraph on page 299 of your July issue, which quotes Mr. Peter H. Peck as saying: "He expressed a preference for the return to the use of a simple, practically designed and constructed locomotive," etc., etc., will certainly appreciate that gentleman's sound logic, and also harbor a friendly feeling for him. Mr. Peck's argument should be reinforced by railway organizations, periodicals and individuals; because it is truth, plain, pure and simple.

In designing and operating a locomotive two different temperaments are required, and the designer of late years has shown the operator no mercy whatever. That the locomotive "of to-day" plays havoc with the engineer's nerves is evident to any observer in that line, and the companies certainly concede the fact, as most of them retain a physician to "detect."

Although I would be considered shoddy authority on valve motion, I would like to say it seems that the Walschaert valve gear, which has been cried down for so many years in this country, is favored with an occasional boost now and then, through journals that once could see no special merit or superiority in it over the Stephenson link motion. Whether it is a loophole to build a still heavier engine, or is a real benefit over link motion, is a question. The heads of mechanical departments generally admonish their subordinates to "let good enough alone." I wonder if people that live in glass houses ever throw rocks?

If, when Jennings was on the "carpet," in your October number explaining to the G. M. how it might have been "a little bit worse," could it have had any bearing should he have argued that a lighter engine and train with same equipment might have saved the engine?

Beardstown.

The Sweet Staybolt.

Editor:

I am sending you by this mail a sample staybolt which I believe is better than any now in use.

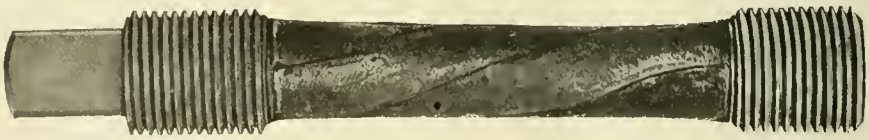
You may remember my suggestion through your paper some years ago that if a staybolt was split in four parts that it would endure many more bendings than if left solid. That scheme was incomplete, for if bent when under strain as it would be in use, an excessive strain would come on one of the four quarters. In the bolt I send this objection is overcome by twisting the four quarters like a rope, and by doing this another advantage accrues.

In splitting the body of the bolt with the proper thickness of cutter, just the same amount of metal is removed as would be cut away by turning to reduce the body to the bottom of the thread. So when the bolt is twisted the four quarters close together and the body is reduced without turning or forging. Such a bolt ought to stand as long as the boiler into which it is put.

I understand that there are two serious objections to it: one that it costs more money, which might make a $10,000 or $15,000 locomotive cost twenty-five or fifty dollars more, and the other and worse one is that it is not like the old style, which has always been used and has always kept breaking.

John E. Sweet.

[We have much pleasure in submitting to our readers the suggestions made by Professor Sweet in the above letter. Professor Sweet has originated so many valuable inventions and improvements that he is not likely to be much mistaken in an engineering idea. The twisted stay bolt is certainly worth trying. —Ed.]



STAYBOLT WITH TWISTED STRANDS, NOT WELDED.

Burning Oil in Shops.

A report on the use of oil being burned in machine shops has just been made by a committee of the Southern Pacific Railway Company, showing that it costs 40 cents' worth of oil to heat one ton of wrought iron to a welding heat, as compared with 500 lbs. of bituminous coal costing $1.25. It costs $12 a day for labor to carry the coal from the coal pits to the furnaces, while one man can supervise the distribution of oil all over the works. An important item is the excellent quality of the iron produced from the scrap metal when heated by fuel oil.

Some of our railroad magnates display such stupendous resources for use in purchasing control of railroad property that people naturally think a combination may be planned some day to purchase control of all the railways in the world. To do this would call for a huge sum of money. Specialists on railway statistics estimate that it would reach something like $40,500,000. There is no other single line of accumulated wealth that represents so much capital as railroads. And it is only about 75 years since they began forming companies.

Mr. A. L. Ruthven, a western inventor, is said to have perfected a device consisting of a double set of contacting electric apparatus whereby an alarm is given if two trains are approaching each other on the same track. The contact may be made automatically or it may be made by hand to stop the trains.

The Kennicott Water Softener Company, of Chicago, have recently received an order for and have under construction eighteen steel storage tanks of the Harriman pattern for the Union Pacific Railroad. Each of these tanks has a capacity of 65,000 gallons.

The joint committee of the Master Car Builders' and the Master Mechanics' associations will meet at the Manhattan Hotel, New York, on December 11 to decide on the place of meeting for next convention.

A Locomotive on Skates.

The skating locomotive which we here show is a steam log hauler which has been used on the former Chippewa Indian Reservation in Minnesota. It is intended to travel over the ice covered roads of that region and draw behind it sleighs loaded with logs for a distance which would make the movement of the logs by teams too costly.

The engine is practically a geared locomotive, the driving wheels of which are covered with a wide endless chain or metal belt, which is provided with teeth or caulks which are driven into the road by the weight of the machine and which thus render the movement of the machine possible.

The front truck is a sled which is pivoted about the center and is capable of motion in either direction. The whole machine is steered by a man who sits in front beside the lower and larger headlight. The two headlights are used, as the road in front of the skater has to be brilliantly lighted in order to give the "helmsman" his bearings.

This engine can be run forward or backward, as required, and is as easily reversed as a steam locomotive, and a speed of from five to seven miles an hour can be maintained.

Our illustration shows this engine standing on what looks like the frozen surface of a pond, and one of the most imperative rules of the company to which this engine belongs is, "no skating on thin ice." It is a sort of automatic rule, because if the engineer breaks the ice he breaks the rules, and if the engine sinks into the waters of the pond it is exceedingly likely that the loss of the locomotive can be traced home to him.

STEAM LOG HAULER IN USE ON THE FORMER CHIPPEWA INDIAN RESERVATION IN MINNESOTA.

Too Much Guarantee.

A story is told of the head of a manufacturing concern who received calls from ten representatives of manufacturers making engineering specialties, each of whom claimed that his apparatus would save the owner 10 per cent. of his coal pile. After talking with one or two of these men and in the meantime receiving the cards of the remainder, he called them all into his reception room and said: "Now, gentlemen, I am too busy looking after the interests of my employers to spend any more time with you today, and as I believe you are all gentlemen and men of character and honesty, I wish you would get together, appoint one of your number as representative with power of attorney to act for you and draw up a combined contract binding each severally to sell me your particular apparatus for so much money, at a whole saving of 100 per cent., which your combined 10 per cent. guarantee would amount to, there being ten of you gentlemen present. I will then sign this contract in which you will guarantee to save me my whole coal pile. Here is a private room where you can pursue your deliberations, and I will furnish you with a stenographer and stationery, etc. I am very glad to have you all call upon me, and shall take great pride in showing my employers that I am so fully awake to their interests and modern engineering improvements that by a combination like this I can save their whole expense for power."

We have heard this story repeated with much gusto by purchasers of steam supplies, but we can see no smartness about it. The representatives might all have had appliances designed to perform practically the same functions and each man had the right to push his goods. The head of the manufacturing concern was a smart aleck.

Facts, Figures and Statistics.

The last report of the Inter-State Commerce Commission gives some interesting railroad statistics for 1904. There were at the end of that year 297,073 miles of railroad in the United States operated by as many as 2,104 corporations. The increase track mile for the year was equivalent to 5,927 single track miles. On June 30, 1904, there were in the service 46,743 locomotives. The total number of cars of all classes, exclusive of those owned by the private lines, was 1,798,561, of which 39,752 were in passenger service and 1,692,184 in freight. The number of persons receiving pay from railways was 1,296,121. This amounts to 611 for every 100 miles of line. The amount paid out in salaries and wages in the year was $817,598,810.

Burning Peat.

The bogs of Maine are as full of peat as the glens of Scotland are. The Boston & Maine Railroad have been experimenting with peat burning on locomotives, and so far the tests have given much satisfaction, the steaming qualities of the fuel being said to be of the highest. The peats are subjected to heavy pressure, which exudes all the moisture. The peats in pressing are forced into an elliptical shape with an inch hole running through them, which admits of free burning. The fuel is entirely free from smoke.

To find the thickness of steel to be used in hollow cylinders under tension, such as pipes lines, etc.: Multiply the specified working pressure in pounds by the radius of the cylinder in inches, then by the factor of safety, and divide the result obtained by the tensile strength of the steel, multiplied by the percentage efficiency of the riveted joint employed.

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Turbines Proving Economical.

Although the steam turbine is older than the Christian era, its development has been exceedingly slow and many obstacles have hampered its application since modern inventors demonstrated that as a power medium it is not inferior to good reciprocating steam engines. The earliest known steam turbine was described by Hero of Alexandria in the Second Century, and was doubtless then an old invention of little practical value. Attempts to make it a practical engine were made about 1624 by Branea, an Italian; in 1650, by Somerset, an Englishman; then it was neglected for over two hundred years until, in 1853, Tournaire, a French engineer, indicated lines on which the turbine might be made a successful steam motor. This exercised powerful influences and directed the attention of De Laral, a Swedish engineer, and Parsons, an Englishman, whose labors brought forth the modern steam turbine.

This form of steam motor has received much attention from American engineers, and Prof. Curtis, of New York, has invented some very valuable improvements. The steam turbine is becoming, on this side of the Atlantic, a favorite form of motive power for electric generating plants, while in Europe its favorite scope is in marine work. British steamship owners have taken the lead in the introduction of turbines for ship propulsion and they displayed great enterprise in this line, for not a few turbines were applied to steamers when the engineering world still believed that turbines would be more costly to operate than reciprocating engines.

A large pleasure steamer with turbine engines was placed on the Clyde three years ago and she gained great popularity through her high speed and freedom from vibration. Since that time turbine marine engines have been growing rapidly in favor in British waters. A series of most virulent attacks on the turbine has been made by German engineering writers, but they were characterized more by spleen than by the statement of facts, and have apparently exercised no influence on public opinion. There are already several large transatlantic steamers provided with turbine power, and one company has on the stocks two huge steamers calculated to make 25 knots (28.7 miles) an hour.

A very interesting and valuable report has just been made public by the Midland Railway of England, concerning the economical working of new turbine steamers that have been in service this season. This railway maintains lines of steamers to Ireland and to the Isle of Man, and in both services have a turbine steamer running which is practically identical with other vessels on the same route propelled by reciprocating engines. The Antrim and Donegal are the old boats, and the Londonderry and Manxman the turbines.

During the season's service, the Manxman made an average speed of 23.4 miles an hour on the same amount of coal required to propel the Antrim 22.5 miles. For the same power there was 115 tons less weight of machinery, and the expense of minor supplies were less. But the smaller fuel bill is the important item the engineering world has been working for.

To Our Patrons.

The transfer of balances, not the transmission of money, is one of the functions performed by the banking system of the country, and the object of this, is simply to facilitate business and prevent loss. When you offer a check in payment of a debt, supposing you have a bank account, or when you buy a post office money order, or an express money order and forward either of these through the mails, you do not send cash, and even if the order is lost, the cash is not, and a duplicate order can subsequently be obtained in the usual way.

We want our club raisers, and, indeed, all who have occasion to make payments to the Angus Sinclair Company, to remember this fact. If you put money in an envelope and send it through the mails you take the risk that the letter may go astray, that it may be stolen, that it may be lost, or that it may be destroyed in trainsit. In any case, if it fails to reach its destination you have to sustain the loss of the money. If any of these things happen to a money order there is no loss of cash because none has been sent; and on proper representation to the post office authorities or to the express company, a duplicate order will be issued and the payment of the original order stopped.

We have lately had this matter brought home to us by hearing of the loss of money said to have been sent to us through the mails, and this loss, in every case, was to the person who sent the money. In the nature of the case, this must be so, and that is why checks, bank drafts and money orders have been devised. The use of the money order saves loss of time, prevents the loss of the money and is more satisfactory to sender and receiver alike. Do not run any unnecessary risk, use the money order every time. The small charge made for the order may be regarded as a sort of insurance which you pay for the safety of the actual cash, and, moreover, the money order receipt which you hold, is proof that you made the payment in a certain way and on a certain date. Railway men will often find an express office nearer their shops than the post office is, and express offices usually keep open later than the post office. Do not run any unnecessary risk where money is concerned.

Navy Getting Worse.

The annual report of the chief of the Bureau of Steam Engineering in the Navy Department is the most serious attack on the methods in vogue in the navy yet published. The report states "that so few engineers of the line are taking up engineering seriously that the situation is becoming alarming." The situation has always been deplorable, but it took the "Bennington" disaster to make it alarming. Admiral Rae might not be willing to admit it, but the whole course of training as carried on at Annapolis begets a feeling of repugnance to the construction, repairing and running of steam engines.

The admiral suggests a plan whereby the younger officers of the line would have engineering duty first in a subordinate capacity, and their record must show their ability before being placed in charge of the engines of any vessel. The plan further provides that in the line there shall be a number of engineering specialists whose duty at sea and ashore would be engineering alone. This plan is a good one if such men could be got, but the organic defects in the Navy Department precludes the possibility of the existence of such men. The idea of a gilt edged, lady fingered, sleek skinned gentleman perferring the smut of industry in an engine room to the sunny atmosphere of the upper deck for the same rate of remuneration is expecting too much, especially in that inane class produced by a course at Annapolis. Indeed, it would be difficult under ordinary conditions to get a young man to grapple with the severe conditions essential to a mastery of steam engineering, when he can earn the same money in the pleasant role of a social dandy. The man who in the smoke and grime of an engine room can fit up a set of eccentrics is not the man who is likely to keep up his end in a set of quadrilles in a ballroom, and the latter is just the kind of man evolved by the Navy Department at Annapolis.

The condition of affairs, judging from Admiral Melville's report two years ago, coupled with the subsequent tragical occurrences in the navy, together with Admiral Rae's report just published, forbids the hope of any improvement in the condition of affairs unless sufficient encouragement is offered to induce young men to forego the luxurious ease of a life of frivolity and bend their energies seriously to an occupation worthy of the best mental and physical attributes of the flower of American manhood. If it were possible to separate the engineering department as completely as the medical department is separated from the line in the army and navy, and sufficient inducement were offered, excellent men could be got from the merchant marine and from the railway service who would devote their lives to their high calling. We hope to see some improvement, but, knowing something of the social barriers that must first be broken down, we hesitate to pray for miracles.

Brakeman, Past and Present.

We do not remember of freemen following a more arduous occupation than that of brakeman on a way frieght train in the times anterior to the introduction of air brakes. We were familiar for years with the life led by fishermen on a stormy, rocky coast, where the fear of starvation kept the boats in the open sea during all kinds of weather. Theirs was no life to envy, with hardship in the daily toil and constant jeopardy from winds and waves. The daily and nightly life of sailors working miserable old hulks that were chronically in danger of going to pieces was brought very close to our own experience for years and we concluded that such men had not much to live for; yet our impression was that their lives were tranquil compared with that of a freight train brakeman in winter on roads north of the Ohio river. Imagine a man scrambling over an ice bound train twisting at frozen brakes with a zero wind that was always a hurricane; down fragile ladders to flat cars, toiling over rough coal with cars swaying and lurching over rough track, up again to the top of a box car that he had to crawl over to keep from slipping, while the engineer kept squealing for brakes, and only strenuous effort on the part of the brakemen prevented dangerous runaways. We have often taken chances at the head end rather than invite the brakeman to climb on top of cars when skin cutting blizzards were blowing and the car roofs were slippery as icebergs.

Yet there was no lack of men ready to do that work and most of them were good men, too. We noticed in reading a club report where the voices of yard men and of conductors were giving testimony, that complaints were repeated to the effect that the material available for brakemen is not so good to-day, when brakemen have an easy time, as it was when they had to endure constant hardships. Our speaker said:

"I find that men that we employ to-day are not as efficient as they were years ago. They do not take the interest in the work. I do not see what it is. They seem to have better education now than we did when we were younger and went into this branch of the service, but they do not seem to take hold of the work in the same way."

Another speaker said:

"I have heard many of our conductors talk a good deal on the same line as Mr. Morrison; that we don't get as good brakemen to-day as we used to, and they lay the trouble to the use of the air brake; that they don't have very much braking to do. I suppose, perhaps, there is something in that. If there is any member of the body that is not exercised it soon becomes withered, and I think some of the brakemen have reached that stage."

We incline to think that the comparative efficiency of the old-time brakeman is made higher by the sentiment that distance lends enchantment to the view, but it is undeniable that a strenuous life develops the higher qualities in a man better than fireside happiness with hours of ease.

Age Limit on Railroads.

It is gratifying to learn that the absurdity of limiting the age at which a railway man is eligible for employment is passing away more rapidly than the promoters of such a measure expected. Already the principal roads in America where the experiment has been tried have abandoned the regulation. The Boston & Maine, the Alton, the St. Paul and the Burlington are virtually ignoring the age limit regulation and, guided by common sense, are hiring men more with a view to their qualifications than to the exact number of years which they may have lived. Experience and capability are the real tests of a man's fitness for any position, and if a railway official makes the mistake of hiring an incompetent man, there is no law compelling the company to continue to employ him. Years in themselves are no exact criterion. Some men are old at forty. Others are young at sixty. In any event it is safe to assume that a lack of the suppleness of youth is often more than made up for by the wider experience of added years.

These thoughts are entirely apart from the inhuman aspect of the spirit that could turn a man away because he had passed his thirty-fifth birthday. It is like adding a new pang to death. It is as if the grim reaper came half way along the hard highway of life and set a mark on a man, and made him an outcast. The spirit that could make and maintain such measures seems to have been nursed in some heartless region outside the pale of the common brotherhood of humanity.

Rails on Bridges.

It is a fact not generally known that fractured rails, although of rare occurrence, are almost invariably found on bridges. This is not to be wondered at in view of the sharp vibration incident to railway traffic on modern steel bridges. The metallic chairs in which the rails rest are defective in resiliance in comparison with ties of closely grained timber resting on a solid foundation set in the earth. The exposure to atmospheric conditions also operates against structural work more readily, and it has been shown by recent tests that steel rails on bridges lost in weight about one pound for every five feet of rail per annum. This is much above the normal wear of good steel rails. The loss in the wearing face is not great, but the external corrosive action on the sides of the rail, and especially under the bottom flange where the rail rests on the chairs is very great.

A careful analysis of the chemical constituents of broken rails also invariably shows a defective segregated composition showing inequalities in the physical mass. The incessant vibratory shocks naturally induce a brittleness in these ill-assorted molecules materially reducing the resisting strength of the rail. This unevenly balanced nature of the chemical composition of the rail is an organic defect which is not by any means accidental but arises from an excess of carbon and manganese. Fractures usually occur where there is a concentrated accumulation of these chemical constituents. The greatest care is not always taken in the thermal treatment of the rail from the ingot to the finished product. The most durable rail is found to be equal in the micro-crystalline quality of every part.

An increase in the size of rails used on bridges might suggest itself to those engaged on structural work. Such a rail set on longitudinal sleepers instead of transverse metallic chairs would lessen the increased liability to fracture which is keeping pace with the constantly increasing weight of railroad rolling stock.

Book Reviews.

Physics. By Mann and Twiss. Published by Scott, Foresman & Co., Chicago. Price, $1 50.

The authors of this book intimate that they have revolutionized the teaching of physics by informing the student in a popular fashion what the forces of Nature do and how they do it. Regret is expressed that real enthusiasm for the study of physics has been waning among students, and the hope is expressed that if physics can be so taught as to develop in the student these elements of power so vital to his future career, there can be no doubt that in due time its educative value will be properly appreciated and its popularity restored.

The authors seems to think that by using familiar forms and appliances to illustrate physical phenomena, they will dispel the indifference with which students listen to the ancient, obsolete examples that have been used in most text books on natural philosophy. Accordingly they draw into service locomotive engines, railroad trains, automobiles, balloons, row boats and a variety of other up-to-date appliances, and proceed to base their calculations and illustrations on the metric system of weights and measures which make the worst kind of a stumbling block on the start to the average American. A variety of illustrations of train speed are given, not in miles per hour or feet per second, but in centimeters per second. The expression 150,000 c.m. per minute, or 25,000 c.m. per second, may be quite intelligible and convey information to college professors who are daily thinking in that foreign nomenclature, but it conveys no idea of speed to the ordinary American.

The sentiment which has produced this book is based on ignorance of the affairs of life. Because sentiment in favor of the metric system of weights and measures has been growing among teachers stimulated by the proselytizing of unwise friends they imagine that the system is gaining popularity among the peope. This is a mistake. This country is no nearer the adoption of the metric system than it was when the agitation in favor of the French system began about fifty years ago. Every new bolt made with standard screw threads, every new lathe made with a lead screw graduated to cut standard screw threads, is an argument against a change to a new unit of measurement. The innocents who are urging a change talk of it causing little inconvenience during the period of transition. It would cause so much confusion and inconvenience that the English speaking people would not endure it for a day. The innocents imagine because the people opposed to a change regard the boisterous advocates of the metric system with good natured contempt, that no sentiment against a change exists. When they go from words toward acts they receive a rude awakening.

The people make vigorous protest when threatened with legislation to make the use of the foreign metrology compulsory, but they continue to be indifferent to distorted teaching. Through the school books pedantic egotism is forcing upon our rising generation a system of weights and measures that all English speaking people refuse to use. Teaching the metric system ought to be classed with the teaching of French, German, Spanish and other foreign languages.

Swingle's Modern Locomotive Engineering Hand Book. By Calvin F. Swingle, M.E. Chicago: Frederick J. Drake & Co. Price, $3.

This book gives carefully prepared instruction to people interested in railway motive power and covers the entire subject of locomotive engineering. The various departments are arranged in chapters with questions annexed that exhaust the part under study in the way that scientific school books are now prepared. The reading matter is very exhaustively illustrated by means of good engravings. It deserves and is likely to take a favorite place in home study literature.

Practical Planer Talks. By Carroll Ashley. Publishers, The Hill Company, New York. 1905. Price, $1.00.

This is a practical book for practical men. It is designed for planer hands, and is for the purpose of assisting them in getting the best work out of the planing machines on which they may be working. No particular make of tool is described, the typical metal planer is the theme, and on the second page there is a good clear half-tone illustration which shows a fair example of the whole class and gives the names of each part, so that no ambiguity can arise in the mind of the reader as to what the author refers to when he uses a certain word to designate a planer part.

The first chapter, if we may so call it, deals with the typical planer, and explains the construction of the tool, the next has some observations on the "planer hand." Then comes the equipment, by which is meant the cutting tools, etc., and several line cuts show what these are like, and an explanation of what they will do is given. Some observations concerning lining up the "rail" occupy several pages, and reasons why the rail can and does get out of alignment are given. As a necessary follower, some "cautions" come next, and then first lessons in chucking, with line cut illustrations of the right and wrong way to do the clamping of a piece of work. Following this is planing cored work and planing all over, and so on.

These few examples give a good idea of the scope of the work which is a book of 80 pages, 5x7 ins. The illustrations are clear and good, and it is well printed and in large type. The book ought to be a decided help to the beginner, and of value to the more experienced workman. It has been written by a man who has done this kind of work and knows whereof he speaks.

Government Regulation of Railway Rates. By Richard Meyer. Publishers, The Macmillan Company. New York. 1905. Price, $1.50.

This book is a study of the experience of the United States, Germany, France, Austria-Hungary, Russia and Australia in the matter of government regulation of railway rates. The author is the assistant professor of political economy in the University of Chicago.

In the outset we are told that the conclusions which have been forced upon the writer after a painstaking study of the subject extending over twelve years are not favorable to government regulation. In fact, he says, "the net result has been the disclosure of such overwhelming proofs of the evils of State direction of industry, or interference with its natural course that he has become firmly convinced of the unwisdom of government regulation of railways or their rates."

The work is one of 486 pages, including an index, and is divided into two parts, the first dealing with the efforts of foreign governments in this direction, and the second part deals with the United States. There are eight chapters in the first part and ten in the second. The book is bound in cloth.

Railway Provident Institutions.

An important report on the subject of Railway Provident Institutions in English-speaking countries forming a volume of nearly 400 pages, compiled by M. Riebenack, comptroller of the Pennsylvania Railroad Company, has just been published. The territory comprehended in the pursuit of reportorial information has been world-wide, railway officials in every part of the globe having been furnished with the printed questions, and out of a total of 300 roads over 200 have furnished data upon which general conclusions may readily be reached.

The character of the data is largely encyclopedic in scope and variety, but is of such a kind as enables members or committees of the Railway Congress to enjoy a fuller conception of railway endeavor toward providing contentment, competence and safety for their employees than has hitherto been possible.

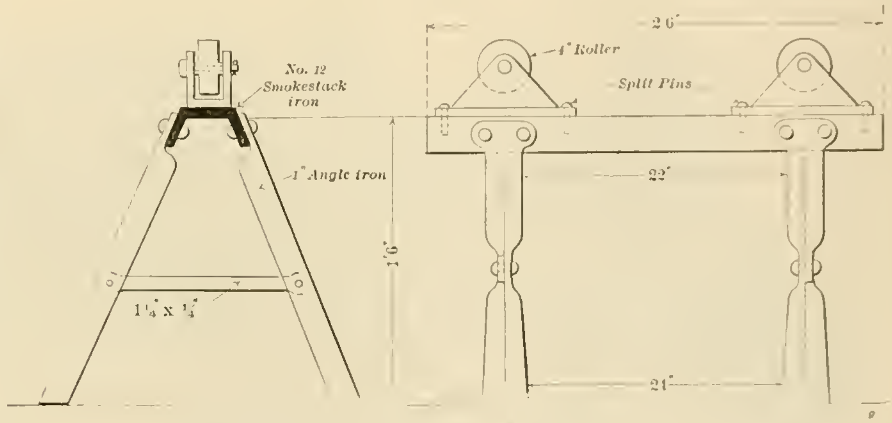
A noticeable feature of the stability of the relief departments is based on the extent to which the railroad companies assume responsibility for their operations and are willing to guarantee their financial obligations. The members are thus doubly protected, first by their own contributions, and then by the ability of the companies to make up any deficiency which may occur.

The number of employees becoming members of these associations averages about 70 per cent. The pension scheme seems to be more largely in vogue on the British railways than anywhere else, but is being adopted on some of the American railways. It is based generally on the period after 10 years' service, the allowance being about one-sixtieth of average salary for each year after 10 years' service. There is much similarity between the American and British systems except that, as a rule, in Britain the membership is compulsory. The retirement ages are also lower in Britain than with the American roads, but the service period is very similar.

In an article that appears in our Correspondence Department, by Mr. O. K. Harlan, on "Superheated Steam," the author states that saving results from superheated steam because there is less leakage past the valves than there is with saturated steam. We are inclined to think that our correspondent is in error on that point. There have been numerous experiments carried out in Europe to determine the economical result of superheating, and the literature on the subject is voluminous. Several reports that we have read stated that the comparatively attenuated condition of superheated steam caused some loss of heat, owing to its tendency to blow through valves and packing. In spite of such losses, however, the consensus of the tests seemed to show that the saving due to prevention of cylinder condensation is sufficient to pay for considerable expense in providing the necessary apparatus and for maintenance of the same.

Smoke Stack Trestle.

A handy, light and easily carried pair of what may be called smoke stack trestles may be seen at the boiler shop of the Canadian Pacific Railway, at Vancouver, B. C. The backbone of the trestle is made of No. 12 smoke stack iron and is bent into the form of a channel with sides sloping outward, something like an inverted trough. This backbone is supported on four legs made of one inch angles braced across as shown in our illustration. The whole thing is 2 ft. 6 ins. long and 18 ins. high. The legs have a slight spread, being 22 ins. apart where they join the back bone and 24 ins. apart at the ground. On the flat upper surface of the trough-like backbone are two rollers, held in brackets. These brackets can be moved anywhere along the top and are held in position each by a pair of large unopened split keys or a pair of iron pegs.



HANDY SHOP TRESTLE FOR SMOKESTACK MAKER

The trestles are used in the making and repairing of smoke stacks and are an improvement on the projecting rail end or other appliance usually placed at the disposal of the smoke stack maker. If the stack to be made is taper a suitable adjustment of the rollers can be had. The trestles can be carried anywhere and are light and strong.

A far-reaching law which pledged the government to suppress train robbing and gave it the power to do so, with a little assistance of the "rurales" or local police assistance made obligatory and not dependent on the rewards offered, has stopped train robbing in Mexico. We want just such a law; it is now before Congress and should be passed. There can be no excuse or palliation of train robberies; there is no state question involved. The law now in the House judiciary committee meets the needs of the country, giving the Federal authorities the power to act, and punishing train robbing so severely that the Claude Duvals of the backwoods will no longer think it a heroic or profitable sport. We need the law and should have it at once to suppress the threatened revival of train robbing in this country.

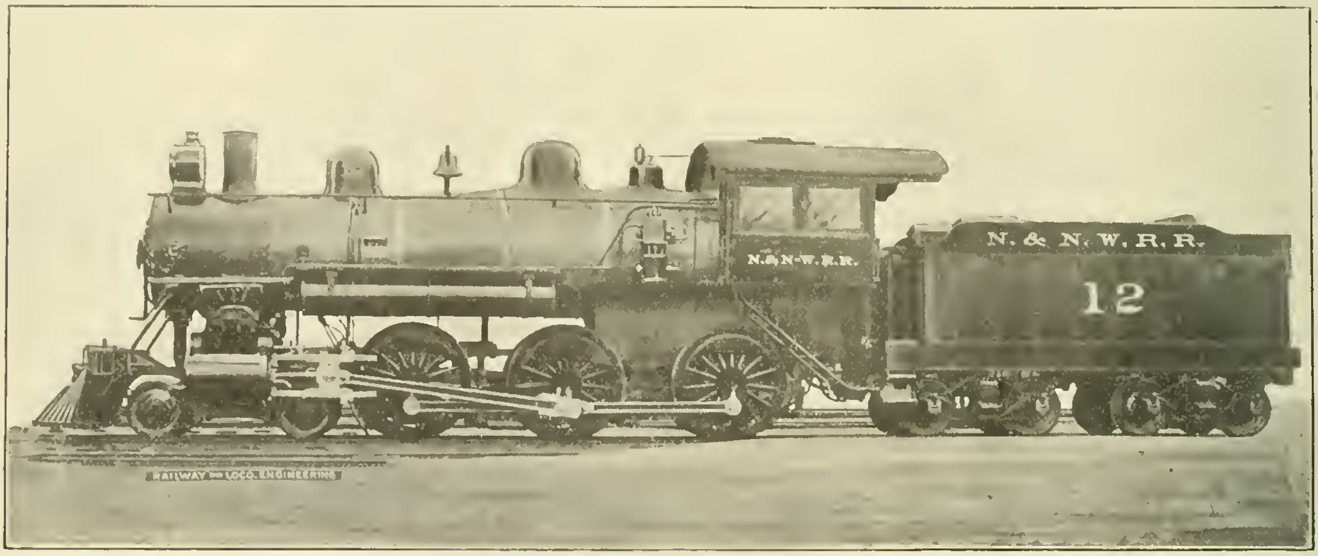
Annoying Delays to Trains in Yards.

Trainmen are frequently exasperated by unexplained delays to trains that they have been called to go out with. Here is an explanation of a common case described in a paper presented to the New England Railroad Club:

One of the greatest obstacles to the satisfactory and economical working of a yard is in the giving of special orders for preferred movement of certain cars. A properly organized yard has its work planned out, hour by hour; the engines distributed so as to work with the utmost freedom and prevent them from becoming bunched and in each other's way, and interference with this arrangement is both demoralizing and costly.

It too often happens that when a track is nearly switched, a house nearly set, or a pier is being filled with cars, that a special order comes to give a certain car, or cars, of dead freight preferred movement, and if by telephone, the clerk may add that the car must be placed at once as it was a case in which J. Pierpont Morgan, or some other important personage, was personally interested and was holding the wire to be advised the time of setting. Of course there is nothing to do but to obey directions regardless of the costly disarranging of switching routine and the inconvenience to which other patrons are subjected.

Many a large yard has been tied up and traffic brought to a standstill in attempting to carry out such orders. I recall to mind a case where ten crews were ordered out on fifteen minutes' interval to clear a yard—the first to leave at eight o'clock in the morning. The trains were marshaled in their respective order; the first, second and third, consisting wholly of perishable freight; the fourth and fifth, merchandise; the sixth and seventh grain; the eighth, ninth and tenth, coal and other dead freight. The conductor of the first crew had his train recorded, his bills checked up, and his running orders when a message was received from headquarters to forward on the first train certain cars which had been made up in the eighth train. The yardmaster endeavored to explain the situation, but he was silenced by being told to obey orders, which he did, but the first train did not get out until eleven o'clock, three hours later than it could have left, and from the fact that the yard was filled to the limit, all trains upon the road had to be held back, the whole resulting in a demoralization and a crippling of the service from which it did not recover for several weeks.



H. B. Sutton, Master Mechanic. NEWTON & NORTHWESTERN 4-6-0. American Locomotive Company, Builders.

Newton & Northwestern 4-6-0.

Some time ago the Newton & Northwestern Railroad purchased from the American Locomotive Company a number of 4-4-0 engines which have given satisfaction on the road, and in the service for which they were intended. The machines were built at the Schenectady shops of the Locomotive Company.

The cylinders are 19x26 ins., simple, with piston valves. The driving wheels measure 62 ins. in diameter and all of them are flanged. The spring gear is of the underhung type. The valves, which are 11 ins. diameter, have a travel of 5½ ins., are actuated by direct motion. They have one inch outside lap and are set line and line in full forward gear, and have ¼ in. lead at 6 in. cut-off. They have no inside lap.

The boiler is an extended wagon top one, 58⅛ ins. diameter at the smoke box end. A pressure of 190 lbs. of steam is carried. The heating surface is 1,986.4 sq. ft. in all, the fire box giving 142.9 sq. ft. The grate area is a fraction over 25 sq. ft. The boiler is liberally supplied with washout plugs above the crown sheet on both sides and plugs are conveniently placed in the corners and in the back sheet. The fire box sides and crown sheets are all of one plate, as is also the casing and roof sheets. There is considerable taper to the gusset sheet, which is the second course.

The tender has a water capacity of 4,000 U. S. gallons and 8 tons of coal. It is made in the ordinary U-shape, and is mounted on a frame made of 10 in. channels. The tender trucks are center bearing with wrought iron arch bars. A few of the principal dimensions are as follows:

Weight—In working order, 140,500 lbs.; weight on drivers, 103,500 lbs.; weight, engine and tender in working order, 226,000 lbs.

Wheel Base—Driving, 14 ft. 4 ins.; total, 25 ft. 4 ins.; wheel base, engine and tender, 50 ft. 4¾ ins.

Wheels, etc.—Material of driving wheel centers, main, cast steel; others, cast iron; thickness of tire, 3 ins.; driving box material, main, cast steel; others, cast iron; diam. and length of driving journals, 8 ins. by 11½ ins.; diam. and length of main crank pin journals, 6 ins. by 5½ ins.; diam. and length of side rod crank pin journals (main side, 6½x5 ins.). F. & B. 4½ ins. by 4 ins.; section of rods, I.

Boiler—Thickness of plates in barrel and outside of fire box, 9/16 in., ⅝ in., 11/16 in., ½ in.; fire box, length, 90 3/16 ins.; width, 40⅜ ins.; depth, front, 74¼ ins.; back, 62¼ ins.; fire box plates, thickness, sides, 5/16 in.; back, 5/16 in.; crown, ⅜ in.; tube sheet, ½ in.; water space, 4½ ins. front; 4 ins. sides; 4 ins. back; crown staying, radial; tubes, number, 250; length over tube sheets, 14 ft. 2 ins. Boiler supplied by two Nathan & Co. Monitor injectors, No. 9.

Tender—Weight, empty, 37,180 lbs.; wheel base, 15 ft. 10 ins.

Clean and Businesslike.

We recently had the pleasure of seeing the New York, New Haven & Hartford roundhouse at Bridgeport, Conn., of which Mr. Edward G. Post is general foreman. There is nothing unusual in this shop, except that it is kept thoroughly clean, and there is a place for everything and everything is in its place.

At this shop a wall cupboard is given to each shop man, engineer and fireman, but each is expected to provide his own lock. A good point about these cupboards is that they are all about 2 ft. from the ground, which permits of the wall being reached by the sweeper's broom. Heating coils and piping can pass beneath the cupboards and the arrangement gives a good appearance to the shop. Most of these cupboards are used to hold clothing and are ventilated and the bottom of each is on the level of a wall shelf and not on the floor. This fact tends to prevent these cupboards from becoming mere rubbish receptacles or fire traps.

The shop is not equipped above other similar shops but its tidiness and cleanliness make it a pleasant place to work in and give it an air of business which larger and less cared for shops might envy.

In order to accommodate the new and heavier locomotives, all of the roundhouses on the Erie Railroad are to be enlarged so as to give a uniform depth to the stalls of 95 ft. The turntables will also be increased to 80 ft. in length.

In talking at the New York Railroad Club on overloading of locomotives, Mr. C. H. Ketcham, of the Lackawanna, made the point that even a man could not do his best when full loaded.

Our Correspondence School.

In this department we propose giving the information that will enable trainmen to pass the examinations they are subjected to before being promoted. If any of our students fail to understand any part of the instructions, we will gladly try to make them plainer if they write to us All letters intended for Our Correspondence School ought to be addressed to Department E.

More of the Series Lessons.

During the absence of the chief editor in summer, his locum tenens blundered with the question and answer course and left out part of the code. The Air Brake Questions of the first series were omitted and part of the general questions of the first and second series, which were purposely delayed because there was an urgent demand for answers to the third series. We now proceed to give answers to the questions which were omitted

When the lessons of the above mentioned course are finished, we will publish answers to the Mechanical and Air Brake Examination of the New York, New Haven & Hartford Railroad.

Air Brake Questions and Answers.

FROM FIRST SERIES.

1. What is an air brake?

A.—It is a brake operated by compressed air, and requires special mechanism for the application of the power.

2. How is the air compressed for use in the brake system?

A.—By means of an air pump, or compressor, located at some convenient place on the side of the locomotive boiler.

3. What are the essential parts of the air brake as applied to a locomotive?

A.—They are an air pump or compressor; an air pump governor; a main reservoir; an engineer's brake and equalizing discharge valve; a duplex air pressure gauge; a plain triple valve; an auxiliary reservoir; a brake cylinder, with a piston in it; and the necessary piping, stop cocks and angle cocks.

4. How many kinds of triple valves are there in use?

A.—Two: the plain and the quick action triples.

5. What is the main reservoir used for and where is it located?

A.—Primarily for the storage of a large quantity of air, to be used in releasing the brakes and quickly recharging the auxiliaries; and secondarily, to catch the moisture, dirt and oil which is pumped in along with the air. It may be located in any convenient place about the engine or tender, but it is usually placed under the boiler, just back of the cylinder saddles, or under the running board.

6. What is the usual standard train pipe pressure?

A.—With the plain quick action brake 70 lbs., and with the high speed quick action brake 110 lbs.

7. What pressure is usually carried in the main reservoirs?

A.—With the plain brake, 90 lbs.; with the high speed brake, from 120 to 130 lbs.

8. Why is it important that all air brake apparatus should be kept tight and free from leaks?

A.—In order that the air brake mechanism may operate properly and that there may be no waste of air, with its attendant evils, or any unnecessary work required of the pump.

9. Where does the air come from that operates the sand blower, bell ringer, air whistle signal, water scoop or other devices?

A.—From the main reservoir.

10. How should an air pump be started?

A.—Very slowly, with all drain cocks wide open. After the water has drained away, close all drain cocks, and when a pressure of 35 or 40 lbs. has accumulated in the main reservoir, open the pump throttle sufficiently to run the pump at a speed that will maintain the required pressure and perform the brake work satisfactorily. The steam end of the pump should be lubricated freely during the starting, just after the drain cocks are closed.

11. How is the automatic brake applied and released?

A.—The automatic brake is applied by allowing the air to escape from the brake pipe, reducing the brake pipe pressure; it is released by restoring the air in the brake pipe to its normal pressure.

12. How many positions are there for the brake valve handle?

A.—Five; they are release, running, lap, service application and emergency application.

First Series of General Questions.

1. Do you consider it essential to your success in business, to abstain from the use of intoxicating liquors? Do you consider it to your interest to work to the best of your ability for the interest of your employer, and be economical in the use of fuel and supplies?

A.—This question will be answered according to the judgment of the man under examination.

2. What are the fireman's duties on arrival at engine house previous to going out on a locomotive?

A.—See that the fire is in the condition to make up a proper fire for starting. See that the ash pan is clean. Ascertain that the engine has got on all the necessary tools and supplies, and that the engineer's oil cans are filled.

3. Is it your duty to compare time with your engineer, and should you insist on seeing all train orders?

A.—I should consider it my duty to compare time with the engineer and insist on seeing the train orders, if that was the rule of the company I was working for.

4. Give the substance of the various rules pertaining to signals as found in the Book of Rules and Regulations of the operating department.

A.—This question will be answered by describing the signals described in the book of rules. The meaning of swinging arms and lanterns in different ways must be explained, and also the meaning that the rules attach to the station signals used by the road.

5. In addition to any that you have not mentioned, what else do you consider a danger signal?

A.—Any person near the track violently waving his arms or any sort of light would be regarded as a danger signal; also a fire burning on the track.

6. Explain the principle of the steam gauge.

A.—There are several kinds of steam gauges, but all of them are operated on one of two principles. When internal pressure is applied to a bent flat tube, the tendency of the tube is to straighten out. That tendency is made use of in the Bourdon gauge, the necessary mechanism for operating the dial needle being connected with the tube. The other form of gauge is operated by a double diaphragm of corrugated plate When pressure is admitted between the plates it forces them outward and the attachments operate the gauge needle.

7. What pressure is indicated by the steam gauge? What is meant by atmospheric pressure?

A.—The pressure above the atmospheric pressure. The pressure of the atmosphere is that imposed by the body of air surrounding the earth. At sea level it is 14.7 pounds to the square inch.

8. What is the source of power in a steam locomotive?

A.—Steam generated by heat.

9. What quantity of water ought to be evaporated in a locomotive boiler to the pound of coal?

A.—From 7 to 10 pounds. It is seldom more than 5 pounds.

10. What is steam, and how is it generated?

A.—The vapor of water. It is generated by the heat from the fuel burning in the fire box.

11. At what temperature does water boil?

A.—At 212° F.

12. What is the temperature of the water in the boiler when the pressure is 200 pounds?

A.—At 200 pounds gauge pressure the temperature of the water is 338° F.

13. What is combustion?

A.—The chemical combustion of the fuel elements and oxygen.

14. What is the composition of bituminous coal?

A.—A good quality of bituminous coal contains about 61 per cent. of fixed carbon, about 31 per cent. of volatile matter, known as hydro carbons; 7 per cent. of ash and 1 per cent. of carbon. There may be a smaller quantity of these elements and some other elements, such as oxygen, iron, etc.

15. What is carbon? From what is oxygen obtained?

A.—Carbon is one of Nature's elements and in the form of carbon dioxide constitutes part of the atmosphere. The quantity of carbon dioxide in the air ranges from 3 to 6 parts per 10,000, but it performs highly important functions since all vegetation depends upon it for subsistance. All woody matter and the material that coal was made from was formed by the carbon dioxide taken from the air.

Oxygen constitutes part of atmospheric air. It is used in combustion.

16. What per cent. of oxygen is in the atmosphere?

A.—20.63 per cent.

17. Is air necessary for combustion?

A.—It is.

18. About how many cubic feet of air is necessary for the combustion of a pound of coal in a locomotive fire box?

A.—It takes 2.66 pounds of oxygen to burn one pound of coal into carbon-dioxide. It takes 4.35 pounds of air to supply one pound of oxygen, therefore it will take 11½ pounds of air to provide the oxygen necessary to burn each pound of coal; as some excess of air is necessary, it is agreed that 20lbs. of air should be admitted to the fire for each pound of coal to be burned. One pound of air fills about 13 cubic feet at ordinary temperature, so we have 13x20 = 260 equal to 260 cubic feet of air needed for every pound of coal burned.

(*To be continued*)

Calculations for Railway Men.

BY FRED. H. COLVIN.

Proportion, or what used to be called "the rule of three" in the old couplet

"Multiplication is vexation, division is as bad.
The rule of three it puzzles me and fractions make me mad."

But there is no need of either being puzzled or mad if we go slow and understand what we are doing.

The first requirement for proportion, and, for that matter, for all calculations, is the ability to do a little reasoning, or, in other words, what is commonly known as "horse sense." Taking the example as given and we know that at a mile a minute or 60 miles an hour, the drivers will revolve 262.1 times per minute. Now, if we want to know how fast it will turn running at the rate of 25 miles an hour we reason that, if it turns 262.1 times at 60 miles it will not turn so fast at the lower rate and so we know that the answer will be lower than 262.1.

So we say, as 60 is to 25 so is 262.1 to the answer, meaning that it will be in the same proportion. We write this as follows, 60 : 25 : : 262.1 : the answer. The single colon (:) means "is to," and the double colon (: :) means "so is," so that the signs read just as we said at first. The way to handle this is to multiply the second and third terms together and divide by the first. In other words, the two inside amounts multiplied together must equal the two outside amounts when they are multiplied together.

Multiplying 262.1 by 25 we have 6,552.5, and dividing by 60 gives us 109.2 as the number of revolutions per minute at this speed. We will have other examples of this later, as it is one of the most useful rules we have.

Having found the number of revolutions per mile let us see what practical use it is to know this and how it is used in actual work. The main use for this information is in figuring out piston speed, or the number of feet which the piston travels in the cylinder. This used to be figured much more closely than at present for fear the piston would get away from the steam, but the steam has a way of keeping a close second to any piston that ever traveled and they never pay much attention to it on this account now. The piston speed is chiefly useful in determining the horse power an engine develops, although it is not customary to rate a locomotive in this way. Still it is a means of comparison and a good thing to know.

If our locomotive has a 24 in. stroke we know that the piston travels twice 24 ins., or 4 ft., every time the wheel revolves. Consequently the piston must travel 4 times 262.1 ft. at 60 miles an hour, or 1,048.4 ft. per minute, and 4 times 109.2 at 25 miles an hour, or 436.8 ft. per minute.

If the stroke happens to be 26 or 28 ins. instead of in even feet, it makes it a little more work but no more difficult. Calling it 28 ins., and we double the stroke in inches, making 56 ins. Then change this to feet by dividing by 12. This gives us 4.66 ft., and we multiply this by the number of revolutions as before.

After we have learned how to find the area of a piston or cylinder, we will take up the problem of horse power and tractive power, which is always of interest.

The area of a circle is the number of square inches or square feet it contains. If it was a square it would be an easy matter to know just how much it contained, as we would simply multiply one side by the other which is called "squaring" it; in other words, multiplying it by itself. But we hardly know how much to allow for the corners. But the same chap who discovered that a circle was always 3.1416 times the diameter wasn't satisfied until he had found that the area of a circle also had a fixed relation to the diameter and he gave us this rule in two ways. You can either multiply half the diameter by half the circumference of the circle, found as before described, or you can "square" the diameter (multiply it by itself) and multiply the answer by .7854, which is the usual way. If the cylinder is 22 ins. in diameter the area will be either 22 times 22 times .7854 or 11 times 3.1416 times 11, in either case amounting to 380.1336 sq. ins.

Now, the power of any locomotive or other engine depends on the area of the cylinder, the stroke of the piston, the steam pressure per square inch acting on the piston and the number of times it moves per minute. Boiled down into a little formula it becomes:

$$\frac{A \times S \times P \times N}{33{,}000} = HP.$$

This may look a little skittish until we read that

A = area of piston in square inches.

S = stroke of piston in feet.

P = average pressure of steam per square inch acting on piston.

N = number of strokes per minute, or double the number of revolutions.

HP = horse power.

This simply means that you multiply together all the dimensions top of the line and divide by the number below the line to get the horse power, first putting the real values in place of the letters.

Calling the cylinder 22 by 30 ins., average steam pressure in cylinder 100 lbs., which would be about right for cut-off with 200 lbs. boiler pressure, and the engine making 130 revolutions, which is about 30 miles an hour for a 76 in. driver. As the piston makes a forward and back stroke for each revolution, we multiply 130 by two and get 260 as the number of strokes, or N. A single stroke is 30 ins., or 2.5 ft., as this must be in feet, and as we already know the area of the 22 in. cylinder to be 380.1336 sq. ins., we are ready to begin, after deciding to drop the last two decimals in this case. The example then becomes

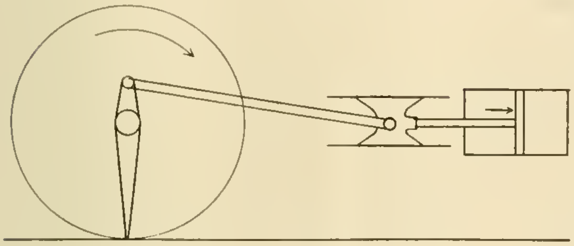
$$\frac{380.13 \times 2.5 \times 100 \times 260}{33{,}000}$$

Multiplying all of the top figures together one at a time, we get 29,708,450, and dividing this by 33,000, gives 748.71 as the horse power of such an engine at such a speed and with this steam pressure.

Put in the form of a rule it becomes: Multiply the area of the piston in square inches by the stroke of the piston in feet, by the average steam pressure per square inch and by the number of strokes per minute. Divide this product by 33,000, because 33,000 ft. lbs. is called a horse power.

This calls for a little further explanation. The unit of work is "foot pounds" or the number of pounds lifted or moved, multiplied by the number of feet it is lifted. A horse power is 33,000 lbs. lifted one foot high in one minute, or its equivalent. It may be 3 lbs. lifted 11,000 ft., or 11,000 lbs. lifted 3 ft., or any other combination that, when multiplied together, will give 33,000.

In our calculations it will be noted



TRANSMISSION OF POWER BY PISTON.

that we have found the number of pounds pressure (the steam pressure multiplied by the area it acts against) and the number of feet through which it moved (number of strokes times the number of feet moved each stroke). These calculations gave us the number of foot pounds of work done. Then we divide this by 33,000, because this number is known the world over as "one horse power."

This shows us very plainly that the power depends on the size of the piston, the stroke, the steam pressure and the speed. This is why an engine develops the most power at high speed in spite of the fact that it seems to be working harder starting a train. In this case it has practically no speed.

So as not to confuse horse power with the usual measure of a locomotive's power, draw bar pull or tractive power, we will take that up next and see just how this works out, as it is not difficult if you just understand what you are after.

Tractive power is the power or effort a locomotive makes to start a train and as there is no speed, is due to the steam pressing against the piston, pulling the main rod against the crank pin, which turns the wheel in the box and moves the engine. This of itself is quite a complicated question if we go into all details of it, but for the present we will be satisfied to consider only the engine in the position shown, with the crank pin on top, as this is the easiest to understand. See Fig. 1.

The length of stroke or the distance of the crank pin from the center of the axle affects to power exerted, as you can find out from experimenting with a baby carriage or a boys' express wagon. Try turning the wheel with the hand on the spokes near the hub and then on the rim and see how much easier it is in the latter case on account of the power being applied further from the center. So in figuring tractive power we drop the question of speed and substitute that of the diameter of the wheel.

Figuring out the rule for tractive power in all its glory includes the consideration of both cylinder, squaring their diameters and multiplying by the constant .7854 and considerable besides, but it all boils down to a very simple little rule if you are satisfied to take the rule without the explanation as to why it is so. The rule is: Multiply the diameter of one cylinder by itself, by the steam pressure available in the cylinder (85 per cent. of boiler pressure) and by the stroke in inches or feet as you prefer. Divide this by the diameter of the driving wheel in either inches or feet, but be sure it is the same as that of the stroke; that is, if you consider the stroke in feet be sure the driving wheel is also in feet. Inches is usually most convenient. Put in formula it becomes

$$\frac{d^2 \times p \times s}{D} = \text{Tractive power.}$$

Where d = diameter of one cylinder the 2 above means square or multiply by itself.

p = steam pressure, taken at 85 per cent. of boiler pressure.

s = stroke of piston in inches.

D = diameter of driving wheel in inches.

Taking our 22 in. cylinder again, 30 in. stroke, 200 lbs. of steam and 76 in. driving wheels, and we have

$$\frac{22 \times 22 \times 170 \times 30}{76} = \frac{2{,}468{,}400}{76} = 32{,}478$$

lbs. drawbar pull.

It will be readily seen that if we cut the driving wheels down to 38 ins. (which would, of course, be impossible with the 30 in. stroke, but is just mentioned to show an extreme case), the drawbar pull would be double, as the divisor would be only half as much. If, on the other hand, we increase the driving wheels to 84 ins., we reduce the drawbar pull in direct proportion and can, if we desire, use the "rule of three" again and say, as 84 : 76 : : 32,478 : the answer, which would be 29,384 lbs.

Changing any of the factors also increases or decreases the result in the same way except that changing the cylinder diameter varies it by the "square" instead of directly. This may sound puzzling, but it isn't if you stop to think a minute. As we multiply the cylinder diameter by itself we can readily see that if we change the diameter from 2 to 4 we have to consider the fact that 2 times 2 is 4 and that 4 times 4 is 16. We have only doubled the diameters but the "square" is four times as much. So if, by any sort of freak, we should change a cylinder from 20 ins. in diameter down to a 10 in. cylinder, we would reduce the power of the engine to one-quarter of what it was before. This is easily proved, as 20 times 20 is 400, and 10 times 10 is only 100, or one-quarter as much.

This is what is meant when we hear that "pipes and circles vary as the square of their diameters," meaning that their areas vary in this proportion. A pipe 4 ins. in diameter will hold four times as much as a pipe 2 ins. in diameter, instead of twice as much, as we might think. This is known as "the law of squares" and while it may not often enter into our calculations it is a very handy thing to know, as it shows you that an inch added to the diameter of a cylinder adds many square inches to the area of its piston and is of much more importance than the same amount added or taken from the driving wheel or stroke.

The tractive power rule figures down to the fact that the square of the cylinder diameter gives the tractive power for every pound of pressure, for every inch of stroke and with a driving wheel one inch in diameter. This sometimes affords a quick way of making comparisons.

Rapid progress is being made in the building of the new foundry of the Brooks Locomotive Works of the American Locomotive Company, at Dunkirk, N. Y. Three immense furnaces have been installed.

The Norfolk & Western Railroad plans to expend about $7,000,000 next year for additional equipment and new construction. This will include 50 heavy freight locomotives and 3,000 freight cars.

Over 100 members of the Board of Railway Employees met at Harrisburg last month and decided to organize the labor organizations with a view to nominating a complete State ticket next fall.

GENERAL Questions Answered

UNEVEN WEAR OF ECCENTRICS.

(113) J. S., Pottsville, Pa.:

Why does the small part of the eccentric wear faster than the larger part? A.—Our observations on the wear of eccentrics has been that the larger part wears faster. It is evident that if there is no soft part in the metal the part furthest from the center will wear faster, on account of its higher velocity of travel in the strap.

STRAIN ON PEDESTAL JAWS.

(114) J. J. G., Americus, Ga., writes:

Which of the two pedestal jaws of the main driving-box receives the greatest strain, and why? A.—The severest strain comes on the back pedestals when the engine is running forward, for the chief reason that the thrust of the main rod backwards is exerting its strength against the acquired momentum of the engine. This is particularly noticeable when the wedges are loose, when the thump in the back of the stroke is more particularly marked than in the front of the stroke.

INJECTOR TEST RACK.

(115) A. E. N., Albin, Miss., writes:

Could you furnish me with information concerning an injector test rack whereby a full test could be made with steam pressure for a shop test? A.—The test rack used by the Nathan Manufacturing Company, of this city, consists of a pipe attached to an adjacent boiler, a suction pipe to a water tank leading beneath, and a delivery pipe. The apparatus, when the injector is attached, resembles the actual position of the injector on a locomotive, except the delivery pipe which has an outlet in a waste pipe. Adjustable valves are attached to each of the pipes.

POSITION OF ENGINEER'S VALVE IN DOUBLE HEADING.

(116) E. P. M., Lowell, Mass., writes:

Referring to (Our Correspondence School) question number 98, and its answer, in September number, will you please advise why, when two engines are coupled together in double heading the second engineer should place the brake valve on lap? Is this done when using some particular make of brake valve. A.—In the earlier days of the air brake many engines were equipped without brake valve cut-out cocks, and when these engines were used in double heading it was necessary to place the brake valve handle, on second engine, on lap in order to give control of the engine and tender brakes to the leading engineer.

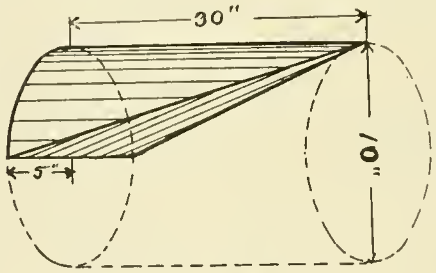
Later, all brake valves were supplied with cut-out cocks, placed in the brake pipe under the brake valve, to be used in cutting out the brake valve on the second engine when double heading, making it unnecessary after closing these stop cocks to place the handle of the valve on lap.

However, some experienced air brake men, as a secondary precaution, favor lapping the brake valve in addition to closing the brake valve cut-out cock, on the second engine.

FINDING THE VOLUME OF A PECULIAR SHAPED TANK.

(117) A reader asks for a rule to find the volume of a tank which is a section cut from a cylinder as shown by the shaded portion of the accompanying illustration, which is shown in perspective to make everything clear. The rule for a figure of this shape is:

Square half the diameter (multiply it by itself) and multiply this by the vertical height or length on straight side. Two-thirds of this is the volume of the tank as shown.



FINDING VOLUME OF TANK.

For the sake of an example we will suppose the tank to be 30 ins. long and the circle from which it is made to be 10 ins. in diameter. Half of 10 is 5, so we say 5 times 5 equals 25. Multiply this by 30 and get 750, and two-thirds of this is 500, the number of cubic inches in the tank. To get the number of gallons divide by 231 as this is the number of cubic inches in a gallon.

This rule only applies to a tank of exact shape and will not work out rightly for a tank where the base is half a circle as in this case and the top runs to a point. If either top or bottom is unlike it is necessary to use a different rule, which will be given if any one desires it.

TRAIN RESISTANCE.

(118) R. McR., Kingston, Pa., writes:

How is the resistance of a train of cars calculated? A.—The general average resistance is calculated on a basis of 6 lbs. per ton on a level track. That is, a car weighing 10 tons would take about 60 lbs. pressure to keep it moving at a speed between four and eight miles an hour. At twenty-five miles per hour it would take 10 lbs. per ton, and at fifty miles, 20 lbs. per ton. Ascending grades or curved lines naturally increase the resistance. In ascending grades the common rule is to multiply the weight of the train in pounds by the ascent in any given distance in feet, and divide the product by the horizontal distance in feet. In curved lines, one per cent. is added for each degree of the curve.

POINT OF LINK SUSPENSION.

(119) C. R. W., Laurel Hill, Fla., writes:

What is the reason that the link is suspended from a point some distance from the center of the link? A.—To make up for the error in motion induced by the angular advance of the main rod. The placing of the point of suspension inside the center of the arc of the link adds to the travel of the valve in one-half of the stroke and reduces the travel in the other half. It would take much space to explain the matter fully. There are several excellent works on valve gearing, and the first section of "Twentieth Century Locomotives" is devoted to a full explanation of the subject.

Zambesi Bridge Opened.

During the meeting of the British Association in South Africa an interesting event occurred in connection with the projected cape to Cairo Railroad. The bridge across the gorge at Victoria Falls, on the Zambesi Railway, and of which we published an illustration in our October issue, was formally opened by Professor Darwin. The falls are 1,660 miles from the Cape of Good Hope and about 4,100 miles from Cairo. The location is too far away from any mass of population, or it would be a popular resort. The Zambesi is the largest river in Africa. Its length is estimated at 2,000 miles, and the Victoria Falls occur about 900 miles from the sea. The river is 2,000 yards wide where it plunges over the edge of the basalt rock over which it flows. The height of the falls is about 400 ft., and the magnificent spectacle is of the most awe-inspiring kind. In comparison with Niagara Falls, the Zambesi is 500 ft. wider, and the height of the falls 240 ft. higher than the great American falls. The volume of water, however, is said to be much less than Niagara, which is about 28 ft. in depth in the center, that of the Zambesi not exceeding 10 ft.

The bridge was built from each side of the gorge simultaneously, and temporary anchors of great strength had to be constructed to hold the work in place. On the completion of the last section the bridge construction at once became a single self-supporting arch, and the great strain was at once relieved. The railway is about 400 ft. above the surface of the river, and its construction is the realization of one of the picturesque aspirations of the late Mr. Cecil Rhodes of South Africa.

Air Brake Department.

CONDUCTED BY J. P. KELLY.

Westinghouse Improved Brake Valves.

Plan views of the automatic and straight air brake valves, used with the new engine and tender equipment, are shown in Figs. 1 and 2.

These views show the various positions of the brake valve handle, and the following instructions explain how the brake valves should be handled while operating the brakes:

In the full release position of the automatic brake valve handle, the brake pipe and the main reservoirs are in direct communication, but the exhaust from the engine and tender brakes is closed.

In running position, the brake pipe feeds up through the feed valve, and the engine and tender brake exhaust is open.

The new position between running and lap, called "holding position," is similar to running position, except that the engine and tender brake exhaust is closed.

The other positions of the automatic brake valve handle are similar to those of the G6 valve.

To apply both train and engine brakes with the automatic brake valve, proceed as with the standard G6 valve.

To release both train and engine brakes with the automatic brake valve, go to full release position to release train brakes, then to running position to release engine brakes.

To release train brakes and hold engine brakes with the automatic brake valve, go to full release position to release train brakes, then to "holding position;" to release engine brakes, move handle to running position. Engine brakes can be graduated off by moving handle alternately to running position and holding position, as would be done with a straight air brake valve.

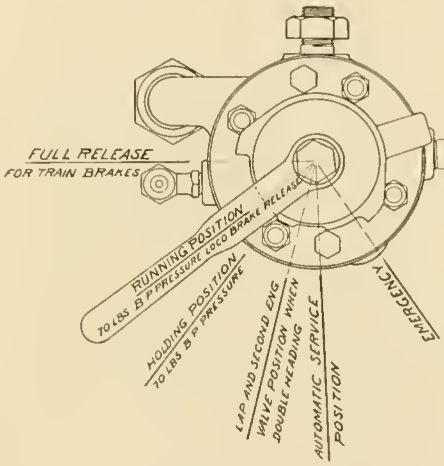
To hold train brakes and release engine brakes, the automatic brake valve handle being on lap, put the straight air brake valve handle in the second, or release, position.

To apply engine brakes only, the automatic brake valve handle being in running position, put the straight air brake valve handle in fourth, or service, position till brakes are sufficiently applied, then to lap position.

When double-heading, put automatic brake valve handle on lap on the second engine, and close cut-out cock under brake valve. Second engine brakes can then be handled by first engineer on second engine by placing straight air brake valve handle in release position. Also, if second engine brakes are applied, and there is danger of overheating tires, or drivers should slide, he can release the brakes by moving the straight air brake valve handle to release position, reapplying later if necessary by using the straight air brake valve in the usual way.

Keep both brake valve handles in their running positions when each is not in actual service.

If the straight air brake valve handle is left in release position, it is impossible to apply the engine brakes with the automatic valve.



AUTOMATIC BRAKE VALVE. FIG. 1.

Engine brakes cannot be released with automatic valve unless the straight air brake valve handle is in running position.

It is important that the positions of the brake valve handle be carefully studied, so that it may be handled skilfully.

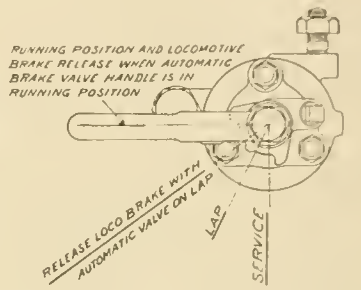
Equalized Pressures.

The law of Boyle and Mariotte states that in the expansion, or in the compression, of a perfect gas, assuming that the temperature remains constant, the product of the pressure by the volume is always constant; or another way of stating this law, the pressure and the volume vary inversely.

This law, though well understood by many air brake students, and one that is in daily use in calculations pertaining to the varying pressure of air, does not, at first sight, appear to account satisfactorily for some of the observed results in practice.

Some time ago we were called upon to explain why it was that a reduction of 20 lbs. from an initial brake pipe pressure of 110 lbs. did not equalize the auxiliary and the brake cylinder, while from an initial brake pipe pressure of 70 lbs. it will do so, the piston travel being the same in both cases.

Although we explained the operation of the law mentioned above as clearly as we possibly could, and our listeners did not doubt the correctness of our statement, yet the working of the law under special cases produced results which they could not clearly understood. We must admit that it is not always easy, by means of word explanation, to make clear to others the



STRAIGHT AIR VALVE FIG 2.

operation of the law of expansion and of compression of a perfect gas—and air is usually considered such—especially under some of the conditions which obtain in actual practice, and, therefore, we shall attempt to do it here by means of graphical figures and illustrations.

In Fig. 1 we have an ordinary rectangle, or a figure bounded by straight lines which make right angles with each other. On the left of this figure is indicated the absolute pressure of the air by the height of the vertical side, reckoned from zero; while on the right, by the vertical height, is indicated the gauge pressure, as shown by the ordinary air pressure gauge; while along the horizontal line at the bottom is represented the volume of air contained in an ordinary auxiliary reservoir of 1,600 cu. ins. capacity, such as is used with 8 in. brake equipment.

If we imagine Fig. 1 to be a reservoir of 1,600 cu. ins. capacity, holding air at 84.7 lbs. absolute pressure (70 lbs. gauge), and we multiply the absolute pressure and the volume together, 84.7×1.600, we will obtain the expression 135.520, which is the constant, or expression, that will always be obtained no matter to what degree the 1,600 cu.

ins., of air may be expanded or compressed, when the resultant pressure and volume, after expansion or after compression, are multiplied together. For example, if we should add a reservoir to the one which our figure represents, of equal capacity, but without any air whatever in it, then allow the air in the first to expand into the second, the resultant pressure would be, supposing the temperature to remain the same, 42.35 lbs. absolute, or one-half. Hence, the pressure and the volume in the second case, multiplied together, equal that obtained by multiplying the pressure and volume of Fig. 1 together.

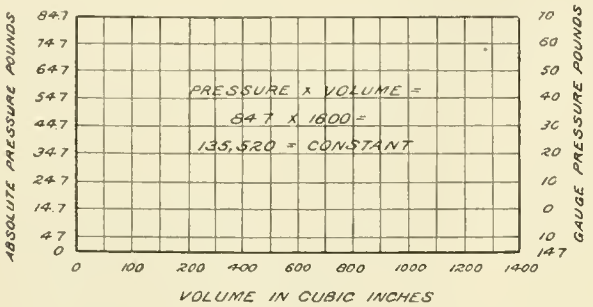


FIG. 1.

Fig. 2 represents the second supposed case, the curved line of which represents the fall in pressure as the volume increases.

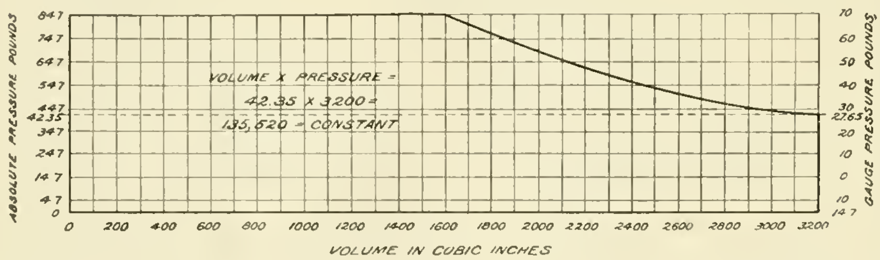


FIG. 2.

If, therefore, the pressure and the volume of a reservoir is known, and it is desired to determine the pressure that will be had after the air has expanded to double its volume, all that is necessary to do is to find the constant or product, of the pressure by the first volume, and divide this by the second total volume of expansion, and the result will be the absolute pressure of equalization. On an ordinary pressure gauge it will show 14.7 lbs. less than this.

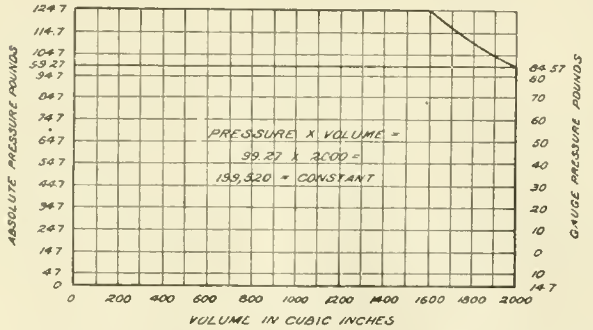


FIG. 4.

Fig. 3 illustrates the constant obtained by multiplying together the pressure and the volume of an 8 in. auxiliary reservoir that contains air at 124.7 lbs., absolute pressure, or 110 lbs. gauge pressure.

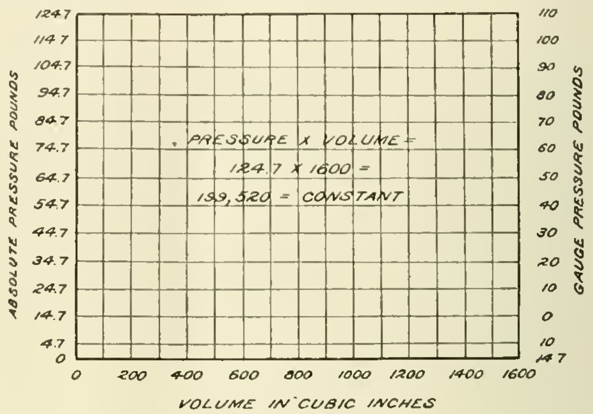


FIG. 3.

The total combined volume of this auxiliary and its corresponding brake cylinder is 2,000 cu. ins., assuming that the brake cylinder, with 8 in. piston travel, contains a volume of 400 cu. ins. The constant is 199.520, as shown, and this divided by 2,000 equals 99.76 lbs., the resultant absolute pressure after expansion into the brake cylinder has taken place. Subtracting 14.7, the pressure of one atmosphere, from this gives us the gauge pressure, which is a trifle less than 85 lbs., showing that the reduction in auxiliary pressure is a little over 25 lbs., and hence that this is the amount of reduction in brake pipe pressure necessary to cause equalization.

Fig. 4 shows the pressure after expansion.

With an initial auxiliary pressure of 100 lbs., as shown in Fig. 5, the constant is 183,520. This divided by 2,000 equals 91.7 lbs. absolute pressure, and subtracting 14.7 from this gives 77 lbs., the gauge pressure, which 23 lbs. less than the initial auxiliary pressure, as shown in Fig. 5. Hence a brake pipe reduction of this amount is necessary to equalize the auxiliary and the brake cylinder when the initial pressure is 100 lbs. These illustrations show conclusively that the higher the initial reservoir pressure, the greater must be the brake pipe pressure reduction to produce equalization.

But this article deals with the matter solely from a theoretical standpoint, and, therefore, the results shown are not what would be obtained in actual air brake practice, since there is clearance space, leakage and waste of air to take into account. For these reasons, it is necessary to add from three to five pounds to the brake pipe reduction as given in the cases cited in these illustrations in order to secure full equalization in actual practice.

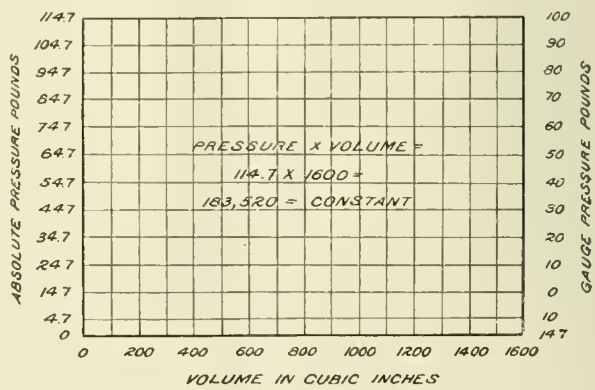


FIG. 5.

Another thing should be borne in mind while reading this article and that is, a 20 lb. reduction in brake pipe pressure will set the brake in full from an initial brake pipe pressure of 70 lbs., and again, that with the high speed brake carrying 110 lbs. brake pipe pressure, a reduction of 20 lbs. sets the brake just as hard as the full service application from 70 lbs.

Fig. 6 shows the equalization from 70 pounds brake pipe pressure, which is some 3 pounds less than is actually required in practice.

The reader can make these diagrams, with the aid of squared paper, for himself whenever he desires to ascertain what pressure will result from any given increase in volume, and after a little practice, construct a diagram, such as shown in Fig. 7, which gives the variation in brake pipe pressure necessary to equalize the auxiliary and the brake cylinder from any initial brake pipe pressure from zero to 110 pounds.

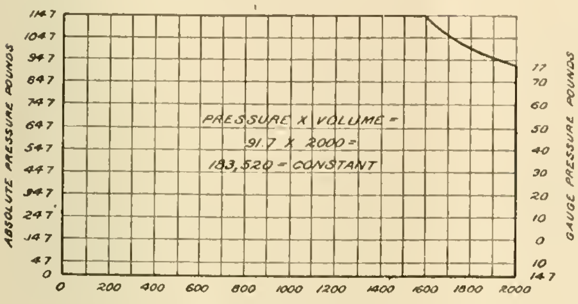
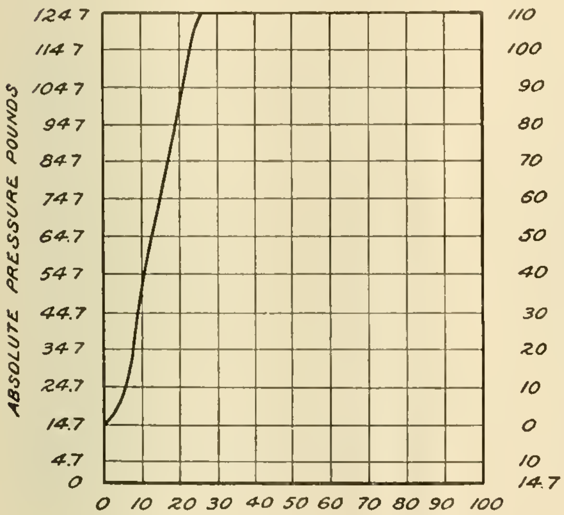


FIG. 6.



CURVE SHOWING REDUCTION NECESSARY TO PRODUCE EQUALIZATION FROM VARIOUS BRAKE PIPE PRESSURES

FIG. 7.

Problems in Train and Brake Operation.

Locomotive Driver, Leeds, England, writes:

How is it that the friction between the brake block and wheel is less at 60 miles per hour than it is at 30 miles per hour? This means that with a given brake block pressure, at high speeds the brake holds less than it does at a lower speed. A.—The surfaces of the brake block and of the tread of the wheel, apparently very smooth when examined by the naked eye, are, nevertheless, filled with little elevations and depressions.

When the brake block is forced against the rotating wheel, as in a brake application, the elevations in one fit into the depressions in the other, interlocking as it were, and producing the resistance to sliding over each other, which is called friction.

At high speed the elevations and depressions on both the wheel and the brake block do not have a chance to interlock so perfectly, or firmly, as at low speed, hence are unable to offer so great a resistance to the rotation of the wheel at 60 as at 30 miles per hour.

2. How is it, when brake block pressure is great enough to cause the wheels to slide, that the holding power of the brake is less than when the wheels are revolving? A.—The point of a revolving wheel that is in contact with the rail is stationary, the same as though the wheel were standing still. Therefore the elevations and the depressions in the surfaces of the rail and the wheel interlock perfectly, and are able to offer all the resistance of which they are capable to sliding over each other. The instant, however, the wheel commences to slide, by reason of too great brake block pressure or other cause, the rough surfaces of the rail and the wheel do not interlock so perfectly, and hence slide over each other with less resistance, because of the small area of surface in contact, than did the surfaces of the rotating wheel and the brake block, thus reducing the holding power.

3. We are at present running long fast freight trains, consisting of from 40 to 50 cars, and occasionally in stopping, these trains break in two. In one case that came under my notice while stopping the train it broke in two 35 cars from the engine, leaving 10 cars in the rear; the distance between the two portions was not more than nine feet. All cars on this train were braked, and at the time the train broke in two, the brake was being applied. The engine was fitted with the equalizing driver's valve. Could you state a cause for this? A.—To handle long air braked trains without shocks and jerks, it is necessary to have the piston travel fairly uniform, and not too short or too long. Where cars having short piston travel are mixed in trains with those having long piston travel there will be an unevenness of braking power; and if the cars having the short piston travel should happen to be placed together at the rear of a long train, they could reasonably be expected to break it in two, especially when applying the brake at slow speed, or at ordinary speeds with a heavy application.

4. I occasionally meet with the following trouble: After the brake has been gradually applied on a light engine with a pressure of from 10 to 20 pounds per square inch upon brake cylinder piston, the engine brake and sometimes the tender brake will release through triple valve exhaust port (I have not had a case where both released together); but if a sufficient main pipe reduction has been gradually made so as to only operate graduating valve, so that brake piston pressure has been anything from 20 to 50 pounds per square inch, the brake does not release, and will stay set, showing the leathers of brake piston to be tight. I have made sure that main reservoir pressure has not been going into main pipe. I have tested cut-out cock, which in our practice is placed between main reservoir and driver's valve. I have also had pipe from main reservoir to driver's valve disconnected before applying the brake, and the above has occurred, with both the old B 11 brass valve and the equalizing driver's valve, no leak could be found in the auxiliary reservoir. The triple valves were the ordinary automatic. A.—Very likely the graduating valve in your triples were leaking, and after the brake valve was placed on lap allowed the auxiliary air to go to the brake cylinder until the pressure had reduced sufficiently to permit the brake pipe pressure to return the triple to release position.

The condition of the brake cylinders packing leathers, if leaking, has a tendency to assist a leaky graduating valve to release the brake.

With a full brake application or nearly so and tight piston packing leathers, a leaky graduating valve will not release the brake.

6. More than 22 years ago we hauled a passenger train consisting of 20 cars from junction A to station B. This caused an engine to be at both ends of the train. In stopping at station B my driver made the stop with the Westinghouse automatic brake, our engine for the time being the train engine. After stopping, the stationmaster came to my driver and said that the passengers in the 18th, 19th and 20th cars from our engine complained of being severely shaken, but that no complaints had

been made from other parts of the train. Both engines were fitted with the B 11 brass driver's valve, and the train with the ordinary acting triple valve. Would you state what you think was the cause of the above? A. It was due, no doubt, to a heavy application of the brakes on the forward portion of the train, which caused the rear cars to come up heavily against those in the front. This kind of application was possible with the B 11 valve and the plain triple, on long trains. The shock would also be greater if the rear engineer had his brake valve cut in at the time your driver was making the application, and allowed air to feed into the brake pipe.

The Westinghouse Quick Service Triples.

The curves shown on the diagram, Fig. 1, which is taken from a report recently issued by the Westinghouse Air Brake Company, illustrates graphically some of the important results of the demonstrations made at West Seneca, in August last, with the new Quick Service triple valves, a report of which may be found in the columns of our October issue, and shows very clearly, so far as distances required to stop in are concerned by the new and the old triple valves, for the same speeds and brake pipe reductions, the superior stopping ability of the new equipment.

Three things in connection with this test, namely, the saving in time that is made possible in getting trains over divisions, the greater degree of safety assured in handling trains on long grades, and the economy in the use of air in all kinds of brake service, should, we think, receive more consideration than the report referred to seems to give them.

The saving in time made possible by the use of the quick triples on long trains is an advantage that progressive railroad men will not be long in recognizing.

Where it is now required on almost all roads at certain points to get heavy freight trains under control so that they may be stopped, if occasion requires, the much quicker, the more powerful action of the new quick service triples for 5-pound service reductions will render reduction in speed of the train in many cases unnecessary; and if not necessary to stop the train at these points no application of the brake whatever need be made.

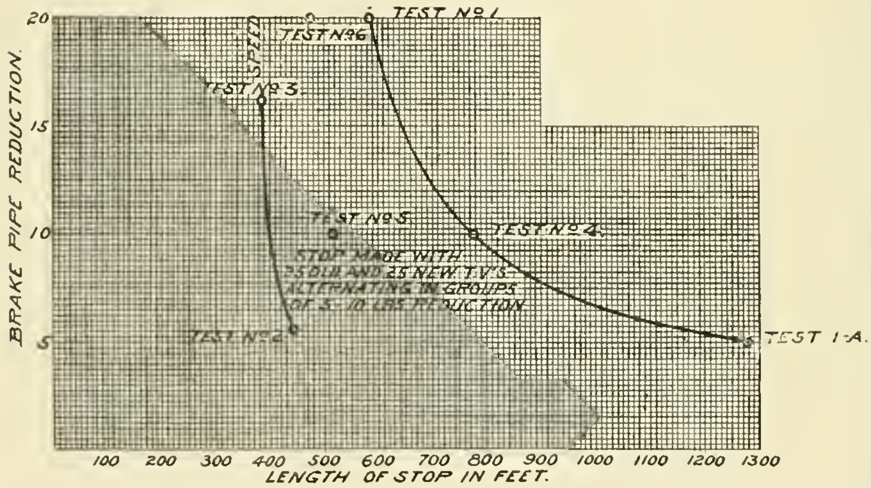
This works an advantage several ways. Less time is consumed in getting the train over the division, and there is a large saving effected in pump work, not to mention the fact that, even if the brake were applied, it might be released at any rate of speed without danger of breaking the train in two.

The handling of trains down long, steep, grades with air, is an operation requiring care, skill and good judgment; also that the equipment be in good condition.

To handle trains successfully on steep grades the equipment should always be maintained in good condition; but where it is possible to use brake pipe air to apply the brakes, as is done by the quick service triple, it is easily seen that "loosing the air" or failure to recharge in time for the next application, on heavy grades, are things that will lose their present sinister meaning.

With equipment in good condition there need never be any trouble from lack of air due to the number of the cars in the train.

The saving in the quantity of air used to apply the brakes on both long passenger and long freight trains, in any kind of service, which the quick service triple effects, is an important item of merit, and must effect a large saving in cost of pump repairs.



QUICK ACTION TRIPLES FIG. 1.

How to Resign.

"Going to resign, are you?" said the superintendent to an indignant person who had been pouring his grief into his ears. "Can't stand it another minute, eh? Put up with it as long as you could, and now you're going to throw up your job and tell your chief what you think of him? Yes, I know. Last straw and all that sort of thing? Uh-huh.

"Did you ever see my set of rules for resigning? I framed them up years ago when I was in the newspaper business, and I have used them ever since. I have resigned often since then, always in the way prescribed by these rules. Perhaps they will be of service to you. Here they are:

"Rule 1. After receiving the last straw don't do anything for two hours. Above all, don't write anything.

"Rule 2. At the expiration of two hours, write your resignation, and make it as hot as you can. Relieve your feelings and say everything you have been penning up in your breast. Scorch the scoundrel.

"Rule 3. Then go home.

"Rule 4. The next morning, immediately upon arising, read over your resignation, and tear it up.

"Rule 5. Go to work at the usual hour.

"Take a copy of them," concluded the superintendent, "and you will find that they are absolutely essential to any man who expects to resign frequently and still continue to rise in the world."

Chance to Sell Old Rails.

A railway supply concern is in the market for 2,000 tons of second-hand steel rails. They are to be 70 lbs. to the yard and the fish plates and bolts necessary to connect them are to be supplied with them. Those having old rails and desirous of filling this order should write "Contractor," care RAILWAY AND LOCOMOTIVE ENGINEERING, 136 Liberty street, New York.

People who wish to study steam engineering and electricity, which are the most important subjects in a mechanical engineer's education, ought to secure "Spangenberg's Steam and Electrical Engineering" from Geo. A. Zellers, 19 So. Fourth street, St. Louis. If you are not prepared to buy the book outright, write for particulars about it and say that we advised you to do so.

There is a greater demand for railway men at the present time than there has been at any time during the last five years. In the West there has never been such a call for experienced men. The Brotherhood of Railway Trainmen are receiving requests daily which they cannot fill.

Of Personal Interest.

Mr. E. A. Williams, previously assistant general manager of the Erie Railroad, has been appointed to the newly created position on the Erie system with the title of general mechanical superintendent. This includes not only the Erie railroad, but also the Cincinnati, Hamilton & Dayton, the Pere Marquette, the New York, Susquehanna & Western, and the New Jersey & New York Railroads. Mr. Williams began his railroad career as a machinist apprentice in the shops of the Milwaukee & Prairie du Chien Railroad. He subsequently held the position of roundhouse foreman on the Chicago, Milwaukee & St. Paul Railway. In December, 1880, he became general foreman of the southern division of the same road, and six years later he was promoted to

E. A. WILLIAMS.

the position of general master mechanic. In 1903 he left the St. Paul road to accept the position of master mechanic on the Minneapolis, St. Paul & Sault Ste. Marie, and on this road he had charge of the locomotive and car departments. Three years afterwards he became its mechanical superintendent. From Minneapolis to Montreal was the next step in his advancement, for in 1901 he was appointed superintendent of rolling stock of the Canadian Pacific Railway. On January 1, 1904, he accepted the position of assistant general manager of the Erie, and his present position as head of the mechanical department of the Erie and its allied lines has been given to him after a little over a year's service on that important trunk line.

Mr. J. B. Carothers, superintendent of the Ohio division of the Baltimore & Ohio Southwestern, has been appointed superintendent of the Illinois division, with headquarters at Washington, Ind.

We are glad to mention that our friend and correspondent, Mr. J. Snowden Bell, has opened an office at 31 Nassau street, New York. Mr. Bell is one of the most successful patent attorneys in the country, and has hitherto made Pittsburgh his headquarters. We recommend that any of our readers likely to have business with the patent office make a note of Mr. Bell's address.

Mr. A. C. Colson has been appointed master mechanic of the Dunkirk, Allegheny Valley & Pittsburgh, with headquarters at Dunkirk, N. Y.

Mr. G. A. Bowers has been appointed master mechanic of the Wrightsville & Tennille, with headquarters at Tennille, Ga., succeeding Mr. Lewis Archer, resigned.

Mr. E. D. Hogan has been appointed superintendent of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn.

Mr. E. R. Scoville, superintendent of the Illinois division of the Baltimore & Ohio Southwestern, has been appointed superintendent of the Ohio division of the same road, with headquarters at Chillicothe, O.

Mr. W. F. Ackerman, master mechanic of the Chicago, Burlington & Quincy, has had his title changed to that of superintendent of shops at Havelock, Neb.

Mr. Carl A. Strom has resigned the position of superintendent of motive power and machinery for the Isthmian Canal Commission, at Panama, and accepted the position of works manager of the Bucyrus Co., South Milwaukee, Wis. Mr. Strom is well known as the former mechanical engineer of the Illinois Central R. R. He was the first engineer under the commission to go to Panama, having preceded Mr. Wallace by a month. He found the shops of the old French company, after twenty years' idleness, practically buried in the jungle, and in a generally dilapidated condition. Within a year Mr. Strom had four shops in operation and had overhauled and put in service more than 75 of the Belgian locomotives he found there, and hundreds of the French cars.

Mr. W. H. Wilson, formerly master mechanic on the Erie, has been appointed superintendent of motive power of the Buffalo, Rochester & Pittsburgh, with office at Du Bois, Pa., vice Mr. E. E. Davis, resigned.

Mr R L Doolittle has resigned as general foreman at Macon on the Central of Georgia to accept the position of chief engineer of the Conden Investment Co. buildings, in Atlanta, Ga.

Mr. F. H Goodyear, who was recently elected president of the Buffalo & Susquehanna, was concerned in other railroad enterprises which have been absorbed by the larger road, of which he is now the executive head. In 1885 he began the construction of the Sinnemahoning Valley Railroad, which extended from a place called Keating Summit to Austin, Pa. This road has been extended from time to time by the construction of new lines and the acquisition of others until it has devel-

C. W. GOODYEAR.

oped into a line 245 miles long, and with the completion of extensions in the bituminous coal territory of Pennsylvania and to Buffalo, it will be about 355 miles long All of these lines are expected to be in operation by the first of July, next. Mr. Goodyear is also president of the New Orleans Great Northern Railroad, which company is building a road north from New Orleans, and, within a year, it is expected that 200 miles of road will be in operation in that section of the country.

Mr. Robert O. Ferran has been appointed assistant foreman of engines of the Pennsylvania, with headquarters at Blairsville, Pa.

Mr. J. W Crowley, foreman of the machine shops of the Central of Georgia, at Savannah, has been transferred to Macon as general foreman of the same road, vice R. L Doolittle, resigned

Mr. F. T. Robertson, formerly general superintendent of the Montana Railroad has been appointed general manager of the same road, with headquarters at Helena, Mont.

Mr. E. A. Albright has been appointed assistant to the president of the Lehigh Valley, with headquarters at 228 So. Third street, Philadelphia, Pa.

Mr. Benjamin H. Glover has been appointed superintendent of motive power and way of the Metropolitan West Side Elevated Railway, with headquarters at Chicago, Ill.

Mr. E. G. Cross has been appointed foreman of the machine shops of the Central of Georgia, with headquarters at Savannah, Ga.

Mr. J. H. Abrams has been appointed superintendent of the Colorado & Southeastern, with headquarters at Hastings, Colo., succeeding Mr. C. H. Bevington, resigned.

Mr. W. C. Hurst has been appointed superintendent of the Detroit, Toledo & Ironton, with headquarters at Springfield, O.

Mr. Frank Cox, formerly planing mill foreman on the Chicago, Rock Island & Pacific at Cedar Rapids, Ia., has been appointed general car foreman of the same road, with headquarters at Davenport, Ia.

Mr. Wm. Matthie has been appointed superintendent of terminals of the Chicago Great Western, with headquarters at Oelwein, Ia.

Mr. F. S. Rawlins has been appointed superintendent of transportation of the Kansas City Southern, with headquarters at Kansas City, Mo. Mr. Rawlins was formerly superintendent of car service of the Cincinnati, Hamilton & Dayton.

Mr. Frank Zink has been appointed acting superintendent of motive power and rolling stock of the Santa Fe Central, with headquarters at Estancia, N. M.

Mr. G. H. Shone, formerly superintendent of motive power and rolling stock of the Santa Fe Central, has been appointed master mechanic of the fourth division on the Denver & Rio Grande, with headquarters at Alamosa, Colo.

Mr. George Geiger has been appointed superintendent of the Southern division of the Kansas City Southern, with headquarters at Texarkana, Tex.

Mr. George Hacket, an engineer on the Wyoming division of the Chicago, Burlington & Quincy, has been appointed road foreman of engines of the same division, with headquarters at Wymore, Neb., vice Mr. S. C. Wheeler, promoted.

Mr. S. C. Wheeler, formerly road foreman of the Wyoming division of the Chicago, Burlington & Quincy, has been appointed air brake instructor for lines west of the Missouri river, with headquarters at Lincoln, Neb.

Mr. A. M. Larsen, formerly on the C. M. & St. P. Ry., has been appointed foreman at the Northern Pacific shops at Helena, Mont.

Mr. J. Goodfellow has been appointed superintendent of the Esquimalt & Nanimo Railway, with office at Victoria, B. C. This road, which is situated on Vancouver Island, has lately been absorbed by the Canadian Pacific Railway.

Mr. Frank L. Ronemus has been elected grand chief carmen at the recent convention of the Brotherhood of Railroad Carmen of America.

Mr. R. H. Bowron, formerly general manager of the Cincinnati, Hamilton & Dayton, has been appointed general superintendent of the Erie division of the Erie Railroad, with headquarters at Jersey City, N. J.

Mr. D. C. Noonan, formerly superintendent of the Minneapolis & St. Louis, has been appointed general superintendent of the same road, the Iowa Central and the Des Moines & Ft. Dodge, with headquarters at Minneapolis, Minn.

Mr. F. D. Weidenheimer has been appointed superintendent of the Sheridan division of the Wyoming district on the Chicago, Burlington & Quincy, with headquarters at Sheridan, Wyo.

Mr. W. S. King, formerly assistant general superintendent of the Yazoo & Mississippi Valley, has been promoted to be general superintendent of the same road, with headquarters at Memphis, Tenn.

Mr. H. H. Hale, whom the printer made to read Hab in the personal column of our October issue, has been, as we stated, appointed assistant master mechanic of the Pere Marquette, with headquarters at Grand Rapids, Mich.

Mr. W. G. Hodgkinson has been appointed roundhouse foreman of the Lake Shore & Michigan Southern, with headquarters at Collinwood, O.

Mr. A. J. Stone, formerly general superintendent of the Delaware & Hudson, has been appointed assistant general manager of the Erie, with headquarters at New York.

Mr. W. F. Kuhn has been appointed roundhouse foreman of the Dunkirk, Allegheny Valley & Pittsburgh, with headquarters at Dunkirk, N. Y.

Mr. W. H. Holbrook has been appointed motive power inspector on the Pennsylvania Lines west of Pittsburgh.

Mr. Milton McCara has been appointed machine shop foreman on the St. Louis Southwestern, with headquarters at Pine Bluff, Ark.

Mr. Henry King has been appointed gang foreman of the St. Louis Southwestern, with headquarters at Pine Bluff, Ark.

Mr. W. C. Park has been appointed superintendent of the Susquehanna division of the Buffalo & Susquehanna, with headquarters at Du Bois, Pa.

Mr. Frank Walters has been appointed general superintendent of the Chicago & Northwestern, with headquarters at Norfolk, Neb.

Mr. L. Strom has been appointed master mechanic of the Mexican Central, with headquarters at Mexico City, Mex., vice Mr. C. H. Burk, transferred.

Mr. C. H. Burk has been transferred to Chihuahua as master mechanic of the Mexican Central, succeeding Mr W. J. Wilcox, resigned.

Mr. S. P. Henderson has been appointed superintendent of the Buffalo division of the Buffalo & Susquehanna, with headquarters at Galeton, Pa.

Mr. W. W. Butler, second vice-president of the Simplex Railway Appliance Company, has been elected second vice-president of the American Steel Foundries, to fill the vacancy caused by the resignation of W. D. Sargent, of New York. Mr. Sargent continues as a director, having served on the board since the organization of the company.

Mr. B. H. Hawkins has been appointed master mechanic of the Delaware, Lackawanna & Western, with headquarters at Buffalo, N. Y.

Mr. Edward G. Post, formerly general foreman at Waterbury, Conn., on the New York, New Haven & Harttord, has been transferred as general foreman at Bridgeport, Conn., on the same road, vice Mr. G. F. Clarke, resigned.

Mr. Horace Cook has been transferred from the foremanship at Winsted, Conn., on the New York, New Haven & Hartford, to be general foreman at Waterbury, Conn., vice Mr. Edward G. Post, transferred.

Mr. William Maynard, formerly machinist at Waterbury, Conn., has been promoted to be foreman at Winsted, Conn., on the New York, New Haven & Hartford Railroad, vice Mr. Cook, transferred.

Mr. F. R. Moulton has been appointed superintendent of the Iowa & Minnesota division of the Chicago & Northwestern, with headquarters at Mason City, Ia.

Mr. H. H. Harrington, formerly general foreman of the Erie, has been appointed master mechanic of the same road, with headquarters at Susquehanna, Pa.

Mr. S. C. Hoge has been appointed general manager of the Louisiana & Arkansas, with headquarters at Stamps, Ark.

Mr. T. B. McCarthy, formerly general foreman of shops of the Southern Pacific, at Ogden, Utah, has been appointed machine shop foreman at the Pittsburgh works of the American Locomotive Company, with office at Allegheny, Pa.

Mr. Archibald Sturrock.

Congratulations are being extended to Mr. Archibald Sturrock, the veteran engineer who was the first locomotive superintendent of the Great Northern Railway of England, and who entered his ninetieth year last month. Mr. Sturrock was the first to introduce high boiler pressure in steam engines. In 1853, when 80 lbs. was considered the limit, he greatly increased the area of the heating surface and raised the pressure to 150 lbs. He made a noteworthy advance in railway travel by introducing an engine with 7 ft. 6 in. driving wheels, a four wheeled bogie in front, and a pair of carriyng wheels in rear, and having a large tender. This engine made 100 mile runs as fast as any engine of the present time and continued in service for seventeen years. It ran from London to Edinburgh regularly in 8 hours, a distance of nearly 500 miles, but there was no demand for such rapid travel by the public nor competition among railways, and the locomotive was really 50 years ahead of its time.

Obituary.

ALBERT J. PITKIN.

It is with a sense of deep personal loss that we announce the sudden and premature death of Albert J. Pitkin, president of the American Locomotive Company, which sad event happened in New York, November 16, the immediate cause of death being nervous prostration. Mr. Pitkin had been in delicate health for some time, but no immediate serious results were expected by his friends. We enjoyed a pleasant visit with him about a month ago, and he appeared well, except that his face showed signs of suffering.

In the sudden call given to Albert J. Pitkin the world has lost a noble specimen of high Christian manhood. It was the writer's fortune, a few years ago, to spend several weeks in Mr. Pitkin's company during a visit to Europe. We were together day and night most of the time, and the impression received of Mr. Pitkin's character was that he was the cleanest man morally, mentally and personally we had ever met. With no avowed pretensions, he displayed a high proclivity to helpful benevolence, with noble charity for all, and malice toward none.

When Mr. Pitkin was elected president of the American Locomotive Company, we wrote: "Mr. Pitkin was born in Ohio fifty years ago, and passed through the machinist apprenticeship in a machine shop in Akron. It was probably his leaning toward locomotives that led Mr. Pitkin to choose a mechanical career, for he tells that when a boy the sight of trains passing his home inspired him with the ambition to be an engineer, which, like many other youthful fancies, faded with the growth of years. Its influence, however, may have guided to some extent his career, for on leaving his home shop he went to the Baldwin Locomotive Works, where he worked for several years, mostly in the drawing office. Then he became chief draughtsman of the Rhode Island Locomotive Works, which he left to become mechanical

ALBERT J. PITKIN

engineer of the Schenectady Locomotive Works, rising there to be general manager. Then, when the American Locomotive Company was formed, he was elected first vice-president.

"Mr. Pitkin has the capacity for working deeply into the affections of his associates. Dr. Williams, of the Baldwin Locomotive Works, used to talk with pathetic regret of the circumstances that took Mr. Pitkin away from his firm. In manner Mr. Pitkin is very cool and apparently subdued, but in fact he is an engine of energy. The writer once followed him for several weeks through Europe, and no matter what sleepless nights or laborious days had been passed, Mr. Pitkin was always ready for a new journey on a moment's notice."

There is little to add. This tireless energy was expended with ceaseless vigor on the vastly important interests connected with the company he managed, and there is little room for doubt that the drain on his vitality was too severe. But his high sense of duty prevented him from faltering till the day's work was done. So now it is all finished. He leaves a widow and four children, Mrs. Agnes Pitkin Barringer, of Schenectady; Misses Elizabeth and Albertina Pitkin, of New York City, and Arthur F. Pitkin, of Providence

M. H. MINER.

It is with sincere regret that we have to record the death of Max H. Miner, of the *Railway Age*. He was an associate editor of that publication and was attached to the staff of their New York office. Mr. Miner graduated from Sibley College, Cornell University, in 1899, and subsequently served as a special apprentice in the shops of the Illinois Central, at Chicago. Later, he became an instructor in mechanical engineering at Cornell and in December, 1901, he joined the staff of the publication of which he was an honored member up to the time of his death. He was a native of Ceremont, Mass., and was just 29 years old when the sudden call came. He was affable to all who met him, and was possessed of a strong sense of humor. His loss will be keenly felt among his associates and his many friends.

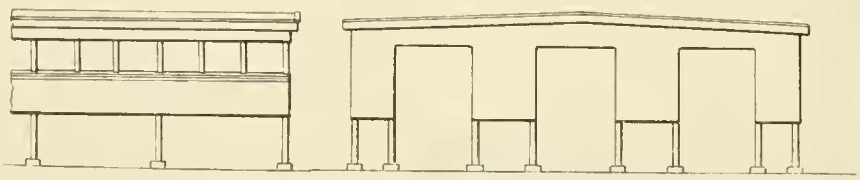
GEORGE ROBERT STEVENSON.

George Robert Stephenson, who died at his residence in Cheltenham, England, on October 26, at the age of 86 years, was the son of Robert Stephenson, the brother of George Stephenson, the great locomotive and railway builder. The deceased engineer began his industrial career at the age of 12 in a colliery. After the success of his uncle as a constructor of locomotives became assured, his father also engaged in engine building, and the young collier was enabled to attend college, and in 1837 he joined the staff of his uncle, then the greatest railway constructor in the world. The young man superintended the construction of the greater part of the South Eastern Railway of England, and portions of the Midland system. He built the first railway in Denmark and in New Zealand He was associated with his cousin in the construction of the tubular bridge over the St. Lawrence at Montreal, which was begun in 1854 and finished in 1859. He built a bridge over the Nile at Damietta. For over forty years he was associated with the great locomotive works at Newcastle founded by his uncle. He was twice President of the Institution of Civil Engineers, and a member of many other scientific societies, and in every way worthily sustained the reputation of the Stephenson family as the foremost railway engineers of the nineteenth century

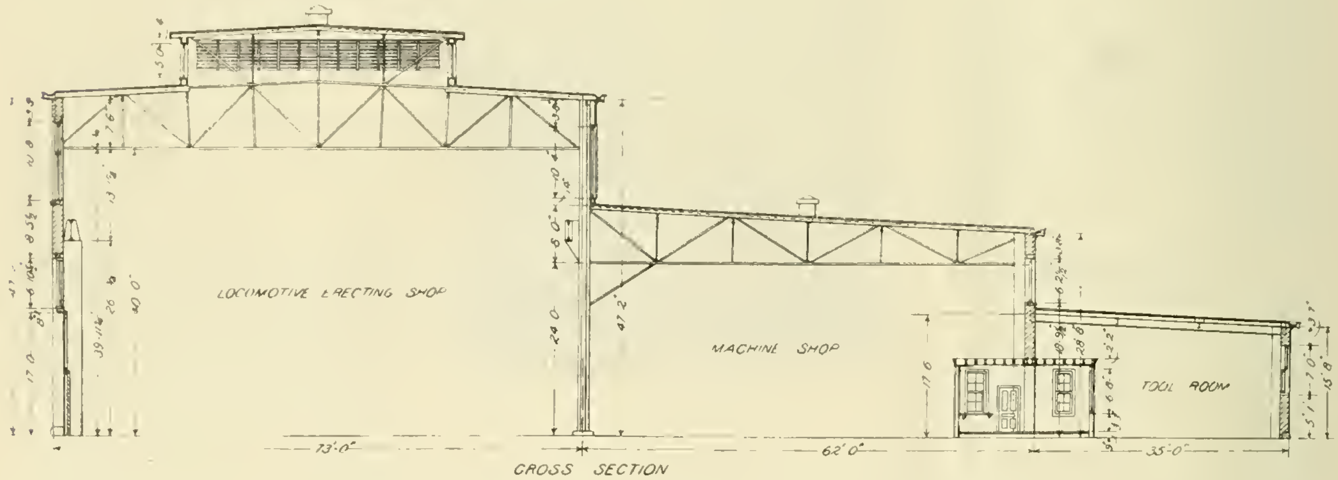
Missouri Pacific Shops at Sedalia.

At the present moment the Missouri Pacific Railway should be judged more by what they have determined upon doing in the matter of commodious, convenient and modern repair shops than that which may be seen by a visitor to Sedalia, Mo. This flourishing town is 188 miles from St. Louis and 95 miles from Kansas City, and is the junction point for the branch to Salina, and is within easy reach of the lines to Kanapolis, Wichita, Florado, Conway Springs and points to the south, as well as the main line east and west. Mr. G. W. Smith, superintendent of machinery, is, however, located at St. Louis. Its central position on the railway line and its desirability as a place of residence have given Sedalia advantages which the road and the townspeople have not been slow to realize.

The shops themselves are substantial structures of brick standing on concrete foundations, the roofs of which are carried upon steel trusses. The section of the erecting, machine and boiler shops which are all under one roof, is clearly shown in our illustration. The main shop is 47 ft. high, and has what may be called an extension along the whole length on one side. The extension is 32 ft. high on its open side and has a height of 28 ft. 8 ins. along its outer wall. From this it will be seen that the main shop is lighted along one side by two rows of windows, one above the other, and on the far side a row of windows above the roof of the extension gives ample light. The main roof is made with a wide clearstory, through which light and ventilation may be had. The whole shop, main and extension, has a total floor space included within a length of 752 ft., and a width of 153 ft.



CAR REPAIR SHED SEDALIA SHOPS, MISSOURI PACIFIC.



ERECTING AND MACHINE SHOPS, MISSOURI PACIFIC RAILWAY, SEDALIA, MO

In this shop there are 34 pits placed at right angles to its length, and these are reached by means of a 70 ft. transfer table, which, having a total runway of about 1,200 ft., serves not only the erecting shop, but the coach and paint shops as well. This table, built by the Whiting Foundry & Equipment Company, is electrically operated and has a capacity of 200 tons. The erecting and boiler shops are served by two Shaw electric overhead cranes, one of them having a 15 ton capacity and the other 120 tons. The boiler shop proper is in the main building with its machines placed conveniently in the extension. The machine shop is located in the extension back of the erecting shop with a small annex in which is the tool room. The heavier tools, such as driving wheel lathes, frame planers, etc., are placed beneath the main roof and material is brought to and from them by the overhead cranes. The machine shop proper is served by jib cranes, overhead air hoists and runways, and has an aisle up the center laid with rails for pushcars or carriers. The heating of machine, boiler and erecting shops and paint shop is with hot air; the remaining buildings are heated by direct radiation from exhaust steam.

The doors on the erecting shop side of the main building are made of wood, and are in two sections, placed one above the other, exactly like the sashes in a window. They are raised and lowered in slides like a sash by a hand wheel which turns a sprocket gear, and this gives motion to a belt chain which turns similar sprocket wheels on a shaft above the doors. The chains from the upper sprocket wheels are attached to the top of the lower door, and when operated pull it up. The lower door is supplied with two feet, as they may be called, made like an angle iron out of $\frac{3}{8}$ plate, $1\frac{1}{2}$ ins. high and 15 ins. long. These feet are on the lower or ground edge of the door, and the projection of the plate angle is on the side next the upper door, so that when the lower door has been raised a distance equal to its own depth, the feet strike the lower edge of the top door, and both go up together. The doors are heavy enough to come down by gravity, but they are counterweighted and the weights are made to slide up and down in the space between the channels which form the door posts. In this way a maximum door opening is obtained, and for the admission of a push car or like vehicle only the lower half of the door has to be opened. This saves wear and tear and time, and the counterweights, being out of the way in the posts, are not liable to be struck or held fast by anything falling upon or leaning against the posts. The posts being made each of two channels with latticework connecting them, give those concerned a chance to get at and adjust the weights as may be necessary. Altogether, the door mechanism is compact, handy and efficient.

The equipment of the machine shop consists of a large number of new tools, each of the latest and most approved pattern, and also the better class of tools from the older shops at Sedalia and St. Louis. The tools are electrically operated under the group drive system. The shop will have a capacity of about 25 engines for heavy repairs, and 30 for lighter repairs each month, and these figures taken in conjunction with the output of the Baring Cross, Ark., shops will give the Missouri Pacific the equipment necessary for thoroughly overhauling its power at the rate of 50 engines for heavy repairs and something over 60 for light repairs per month.

Just here it may be mentioned that system of repair classification adopted by Mr. A. W. Sullivan, the general manager of the road, eliminates the shadowy and uncertain line of demarkation which always exists between light, medium and heavy repairs, where these are determined by any attempt to arbitrarily fix the maximum for each. As one class of repairs shades off toward the one above or below it, the Missouri Pacific have for their own purposes made use of the expression "general repairs" for all work done in the shops, while the words "running repairs" are made to cover such work as can be handled in the various roundhouses without keeping an engine away from her legitimate service on the road. The general repair classification is capable of more definite subdivision by reason of the fact that an engine whose repair work has cost anything below or up to $1,000 is said to have had general repairs, class No. 1. Engines which have cost the company over $1,000 but less than $2,000 to overhaul are in class 2 of general repairs, and so on up the scale. The numerals indicate the amount in thousands of dollars.

In thus getting down to the dollar and cent basis, the general manager has provided himself with a system which lends itself readily to tabulation and can be quickly handled by the statistician. The totals of all costs in classes 1, 2, 3, 4, 5, etc., can be made up at the end of the year and the average of each quickly computed. The average of averages can be had if desired, and with this system in vogue the board of directors at their annual meeting may see at a glance the proportionate and relative amounts which have been absorbed by each class during the year. The comparison of expenditure in the large shops per class with what is done in the roundhouses will, no doubt, prove interesting and instructive.

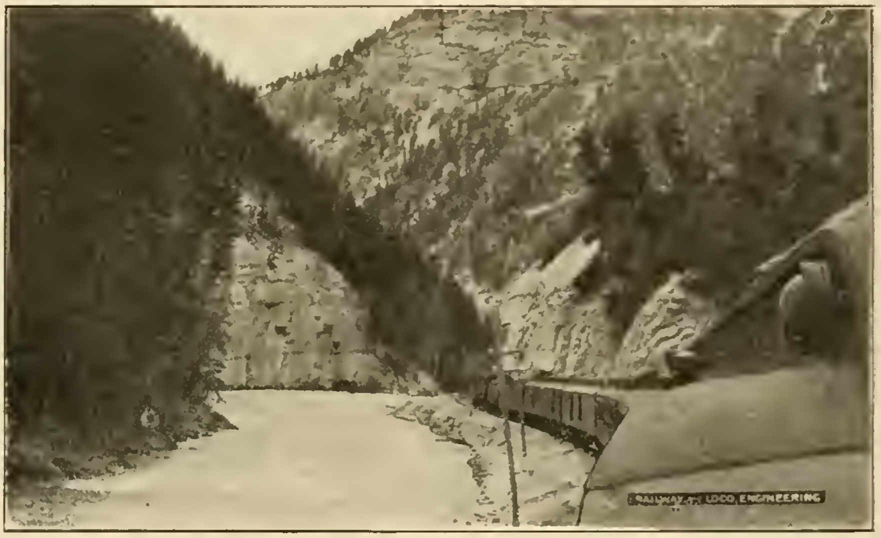
The company intend to have their maximum work done in the summer months, so that, as the fall and winter approach, when traffic is heavy and the work of operation more difficult, they will be in good shape to meet any emergency. In the spring of the year the power will probably be somewhat below par, but with the months of maximum repair yet to come.

To return again to the shops themselves, the ground plan shows the location of coach and paint shops, which are separate buildings similar in general plan and construction to the machine and erecting shops. Each has 14 pits placed at right angles to the length of the buildings, which are of equal size. Each has a length of 312 ft. and a width of 100 ft. Each is lighted with two rows of windows, though the upper ones, on account of the height of the buildings, are about half the size of the lower ones. A clearstory of suitable size provides for additional light and also for ventilation. The coach shop, however, has an annex at the back in which truck and bench work will be performed.

A short distance from the main shop, and at right angles to it, the planing mill, the blacksmith shop and the power house have been placed. The planing mill, located partly beyond the line of the end wall of the main shop, is reached directly by a track which is served by the transfer table. This shop is 268 ft. long by 50 ft. wide, and, though built with double rows of windows, is without a clearstory. It is equipped with conduit pipes for carrying away chips and sawdust, so that the accumulation of rubbish is impossible and the air in the shop is always pure and as free from dust as possible.

At a distance of about 150 ft. from the planing mill stands the smith shop, measuring 244 ft. long and 100 ft. wide. This building has, close beside it, a post iron rack and also a sheet steel and flue rack. The smith shop is built with upper and lower window rows. The roof has a long ventilator top, with stationary louvers. The wooden partitions which divide the ventilator into sections are covered with 1 in. cement plaster laid on wire laths on both sides. The shop contains 44 fires, in addition to 4 heavy forges for framework, etc. At the end of this building, near the freight shop, is placed such machinery as is required, such as bolt cutters and bolt headers, bulldozer, heavy punch and shears, and arch bar drills.

About 100 ft. from the smith shop, and back of the toolroom annex, stands the power house, a building measuring 183 ft. long by 84 ft. wide. It is divided into three sections, and between each is a solid brick wall, pierced each by only one door. This arrangement makes the buildings as nearly fireproof as it is possible to be. One side of the power house is occupied by the dynamo room, while the central portion, a narrow space measuring 20 ft. wide and 183 ft. long, is the pumproom. This section is capped by a ventilating clear story. The other section contains a battery of five boilers of the Aultmann and Taylor type, furnished with automatic stokers. In the dynamo room is a large duplex



KICKING HORSE CANYON, CANADIAN PACIFIC RAILWAY SNAPSHOT TAKEN FROM ROOF OF MOVING COACH.

Rand air compressor with a capacity of 2,000 cu. ft. of free air per minute. The electrical equipment consists of three Murray engines, each driving a 200-kw. direct-current generator. There is also one Westinghouse engine and dynamo of 100-kw. capacity, used on the lighting circuit of the shops. A high water tank, with a capacity of 317,000 gals., is located close to the power house, and a concrete-floored oilhouse, 30x50 ft., is placed near by, within easy reach of the main shop.

The office and store building is on a line with the machine-shop end of the main building, and has two stories. Its floor measurement is 50x201 ft., and it has a track beside it, leading from the yard and continued nearly up to the machine shop. On the upper floor is the office of the master mechanic, Mr. S. M. Dolan, with his staff. On this floor the lighter store material is carried, while below are heavier goods. Beyond is a commodious casting platform, and off to one side is that very important adjunct to the storekeeper's department, the scrap bin and platform.

Back of the group of buildings usually called "the shops" is a freight-car repair shed measuring 400x70 ft. This building contains three tracks, and is in reality what its name implies. It is roofed over, but is open along its entire length. The first opening is placed about 2 ft. below the eaves, and the uprights divide it into a series of spaces 6 ft. 8 ins. by about 4 ft. 6 ins. Below this the sides of the building are closed, but the lower portion, 8 ft. 4 ins. from the ground, is open, the side posts, spaced 20 ft. apart, being visible. The lower opening permits workmen to pass in and out of the shed at all points, and material to be brought in as required, while the upper open spaces provide light and permit material also to be passed in for the upper portion of the cars undergoing repairs. Beyond this shed, and, indeed, back of the shops, the repair and storage tracks are laid out.

The entire plant has been well designed and the details worked out with the greatest care. The movement and distribution of material has been fully considered, and arrangements have been made so that a piece of raw material is never permitted to retrace its steps, if one may so say, but moves always forward from the point of its reception on the ground until, as a finished product, it takes its place on the engine for which it has been prepared. Mr. W. H. V. Rosing, the company's mechanical engineer, has had the work of selecting, placing and installing the entire equipment for a plant which will, when in full working order, employ from 1,800 to 2,000 men, and which will have cost the Missouri Pacific in the neighborhood of a million dollars.

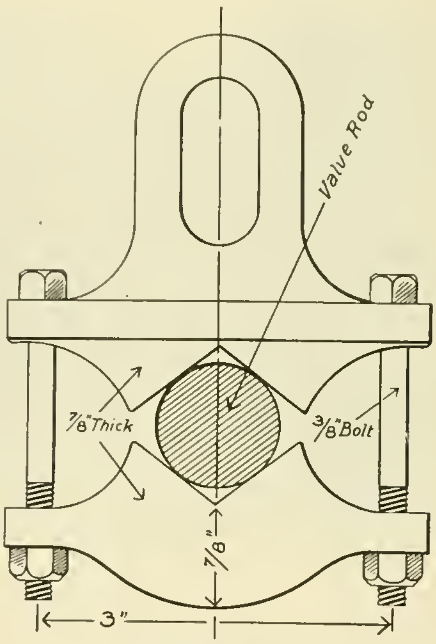
Scottish Graduate.

A canny Scot who had made some money selling groceries in his native town, went to London for a season. He observed that among his new acquaintances were many who had extracts from the alphabet attached to their names. B.A., and LL.D., and other mysterious combinations puzzled the retired grocer, but he was not to be belittled in this way. He ordered cards with the inscription: Thomas McNab, L.F.P. One of his English friends ventured to ask what the letters referred to. "You see," said the ex-dealer in oatmeal and potatoes, "that's the proper caper hereabout—that's my veesiting caird—Tammas McNab, Lately From Paisley."

Ever Ready and Always Handy.

There is a little clamp which you can see on the valve rod of nearly any engine on the New York, New Haven & Hartford Railroad which is ever ready for business and always handy for the engineer when he comes to use it. We show this serviceable valve stem clamp in our line illustration which is usually put on the right-hand valve rod of an engine, and tightened up there, so as to be where it can be seen and felt and easily got at when it is wanted.

The clamp is made of brass about 7/8 in. thick and is formed with a V-shaped notch top and bottom so that it will grip the stem. These V-pieces are held together by a couple of 3/8-in. bolts placed about 3 ins. apart. When any breakdown occurs in which it is necessary to hold the valve on its center, the clamp is loosened from its usual position and one of the gland stud nuts is taken off and the swab holder removed, and this clamp is put on against the stuffing box, the oblong hole being slipped over the gland stud and the nut run up and made fast, the valve



VALVE STEM CLAMP.

is placed in the required position and the clamp jaws tightened. This holds the valve firmly in place and the whole operation is very quickly performed.

When not in use the clamp is carried on the valve rod near the rocker and it is always on view and so placed that if lost, it becomes, as the newspapers say, conspicuous by its absence. It will not stay in place if even one nut is gone, so that if it is in evidence at all, you know that it is in working order. When wanted, no dreary search in the bottom of the tool box is necessary, the clamp is out in the open and on deck all the time. It is small but efficient and is ever ready and always handy.

Another way of clamping the valve stem has been provided by the N. Y., N. H. & H. There is of course a bolt in the top of the gland which holds a flat piece of brass perhaps 1/8 or 3/16 in. thick and through a hole in the projecting end of this flat piece the oil cup is screwed. The bolt is made long enough to all but touch the valve stem inside the gland, and when it is necessary to hold the valve stationery the flat piece holding the oil cup is removed and the bolt can be tightened down on the stem and hold it as a set screw holds rod key. These devices are simple and they cannot be lost without the engineer knowing it.

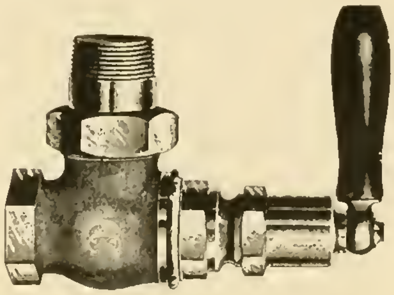
An illustrated pamphlet embodying a lecture delivered before the American Chemical Society by Mr. Maximilian Toch, on "The Permanent Protection of Iron and Steel," has just been published by the Toch Bros., Specialists in Paint Making, New York. The work presents a series of extensive experiments in the preservation of iron and steel structures, with illustrations of the results of the experiments. The question discussed is a very important one, involving as it does the stability of our modern high buildings. The insidious weakening effect of progressive oxidization is pointed out, and emphasis is given to the singular fact that where two pieces of steel or iron come in contact in a building rapid oxidization takes place at the point of contact. Mr. Toch points out several methods by which corrosion can be prevented and oxidization arrested, and we cordially recommend a perusal of the pamphlet to all who are interested in structural iron or steel work.

Quite an interesting and instructive publication has lately come to the office It is on the Mallet Articulated Compound Locomotive which was built some time ago for the Baltimore & Ohio Railroad by the American Locomotive Company. The little book is uniform in size and getup with the other publications issued from time to time by the builders.

The descriptive specification of the Mallet engine is given and there is a good half-tone and several line-cut illustrations showing what the engine is like. The letterpress gives a very full description of the engine and there is an article on the subject by Mr. J. E. Muhlfeld, general superintendent of motive power of the B. & O., and some comments from writers in the technical press. A number of pages are devoted to line drawings showing the articulated locomotive design as adapted to a six-coupled compound engine, a six-coupled tank compound, a six-coupled compound road engine and a four-coupled tank compound. Those interested should write to the American Locomotive Company for a copy.

Improvement in Valves.

Crane & Co., of Chicago, the popular manufacturers of wrought pipe valves and fittings, are constantly placing new devices on the market. The annexed illustration represents a new quick-opening, self-packing steam radiator valve. The self-packing device is an excellent one consisting of a vulcanized washer, located in the top of the stuffing box and kept in place by spring compression, precluding the possibility of leakage. These valves also open by turning the lever handle one-half turn and are so constructed that they bear tightly on their seats and remain locked in place until released. Old valves can be readily fitted with these improvements. Cherry wood handles and nickel plate finishing give an elegant appearance to these valves and they ought to become immediately popular in first class apartment houses and all well furnished residences.



CRANE'S SELF-PACKING RADIATOR VALVE.

Boston Bostoned.

The Duke of Argyle some years ago was traveling in Canada on a hunting trip. He joined a Canadian Pacific train about twenty miles from Manitoba, and, having been roughing it fairly hard, the duke, as he sank into a seat beside a fine young lady from Boston, looked as begrimed and weather beaten a trapper as ever brought his peltries into the settlements.

"Don't you find it too utterly passionful sympathy with nature's most incarnate aspirations among the sky topping mountains and the dim aisles of the horizon touching forests, my good man?" said the soulful lady after an interval.

"Oh, yes, yes," replied the apparent backwoodsman, "and I also am frequently drawn into an exaltation of rapt blissfulness and beatific incandescent infinity of abstract contiguity when my horse stumbles."

"Indeed," said the Boston maiden, "I had no idea the lower classes ever felt like that."

Steamers are, from a traveler's point of view, fifty per cent. safer than sailing vessels.

Patent Office Department.

ANNUAL REPORT.

The Commissioner of Patents, in issuing the annual report of the department, announces that the year ending June 30, 1905, was the banner year in its history. The report states that there were 52,323 applications for mechanical patents, while 30,266 patents were granted. The United States easily maintains its rank as the most inventive country in the world. It is interesting to recall that the first patent issued under the act of 1790 was granted for making potash, and the last patent issued at the close of the first century was for an electro typesetting machine. The first patent issued in any country of which we have an authentic record was in the time of Edward II of England, when a patent was issued to "two friars and two aldermen for an alleged discovery of the philosopher's stone." Patent rights were a fruitful source of controversy in European countries for many centuries. The United States Government from the beginning held that "Patents should be regarded in their true light of rewards dictated by sound public policy to meritorious men who contribute by their creation to the welfare of the country and of the world."

The following brief notes refer to improvements in locomotive and railway mechanism for which patents were granted last month:

VALVE-GEAR.

G. and C. King and H. Barnhart, of Marion, Ohio, have patented a valve-gear, the claims embracing a link-motion, a guide-block having a recess therein, in combination with a valve stem, a journal-pin mounted in the guide-block and passing through the eye of the valve stem, the guide-block being provided with screw-bolts connecting it to the guide, whereby wear may be taken up.

JOURNAL-BOX LID.

An improved device for operating and closing journal-box lids has been invented and patented by George A. Woodman, Chicago. The device consists of a coiled spring operating by expansion to hold the lid in open or closed position, and also operating by torsion to assist in closing the lid.

REVERSING-VALVE.

A device consisting of an unattached steam-valve seat within the steam chest, having two port-bearing regions, a reversing valve beneath said valve-seat exposing simultaneously half of each port-bearing regions and arranged to reverse such exposure, has been patented by Brinay Smartt, Nashville, Tenn. The mechanism is constructed to cover one-half of each region while the other is uncovered, and vice versa

LOADING AND UNLOADING APPLIANCE FOR STOCK CARS.

Mr. William J. Ray, Chicago, Ill., has patented an apparatus comprising a stationary platform, and a vertically movable gangway hinged at one end, and adapted to engage the platform and counterbalance mechanism and swinging gates at opposite sides of gangway, and a folding apron at the free end of gangway. The apparatus readily folds into small bulk, and is well suited for loading and unloading live stock in cars.

STEEL CAR WHEEL.

An improved car wheel has been invented and patented by Mr. Frank W. Hudson, St. Louis, Mo., combining a soft-steel body portion, and diagonally arranged hard-steel inserts whose outer faces are flush with the soft-steel tread, the inserts extending around the throat of the wheel and being capped and held in place by an overhanging portion of the soft-steel flange.

TANK WATER STRAINER.

An improved tank water strainer has been invented and patented by Mr. Joseph McAfee, Philadelphia. It consists of a cast-iron chamber under the tank with a double-faced valve of the disk type, the valve being moved by a spiral screw and extension lever projecting through the upper part of the tank. A substantial screen encircles the outer and inner chambers of the apparatus and a discharge opening under the chamber renders the cleaning of the screens and valve easy of accomplishment. The device is simple and substantial.

SAFETY VALVE FOR STEAM BOILERS.

Mr. William F. Thorn has patented a safety attachment for steam boilers, comprising a valve controlling the blow-off and operable in case the blow-off pipe or its valve becomes inoperative, a stem for actuating the valve, and a guide for the stem with valve wheel mounted and stuffing box through which the stem passes.

LUBRICATING JOURNAL-BOX FOR RAILWAY CAR AXLES.

A device for lubricating axles has been patented by Mr. A. J. Marshbank, Harrisburg, Pa., consisting of a roller bearing against the lower side of the journal, and an arc-shaped spring in the bottom of the box, the purpose being to revolve the roller and thus lubricate the journal.

PACKING BOX.

Mr. Howard D. Shear, Grangeville, Idaho, has patented an improved packing box comprising a stuffing box embodying a longitudinally adjustable gland and having a base to bear against the casting, and adjustable bolts carried by the flange and engaging the base to effect later adjustment of the stuffing box.

LOCOMOTIVE DRAW-BAR.

Claude E. Mentzer, Albert Lea, Minn., has patented a locomotive draw-bar which combines a draw-bar and coupler-head, a locking member, and fluid-actuated mechanism for raising and lowering the draw-bar and also for operating the locking member, with means located within the engine-cab for controlling the supply of fluid to the mechanism.

DRAIN VALVE FOR CYLINDERS.

A patent has been granted to John A. Kennedy-McGregor and Harry Wren, Birmingham, England, for a drain valve for cylinders. The claims embrace a casing having two inlet ports and an outlet port, two sets of duplex valves mounted on telescoping valve stems operable to control the inlet and outlet ports and a balancing means to maintain the duplex valves in their position.

PISTON-PACKING.

A system of piston-packing has been invented and patented by Philo H. Weaver, of Pittsburgh, Pa., consisting of a spring-metal tube adapted to engage over the piston rod, the tube being slit longitudinally at one point in its periphery from end to end with laterally engaging portions and one or more hooks extending from the periphery to the inner end of the tube, and a soft packing surrounding the inner end adapted to circumferentially compress the tube about the piston rod.

A new design of steam whistle has been patented by Mr. John T. Horan, Dayton, Ohio. The device consists of a metallic bowl having an apron therein, and a bell having a series of partitions and a stud fitted into the apron, the bell being solidly sustained against the marginal portion of the body of the bowl by the stud. The device has the element of solidity and strength in a very marked degree.

The United States Civil Service Commission announces an examination on December 6, 1905, to secure eligibles to fill vacancies in the position of mechanical draftsman on the Isthmus of Panama. Full information may be had by applying to the Civil Service Commission at Washington, D. C.

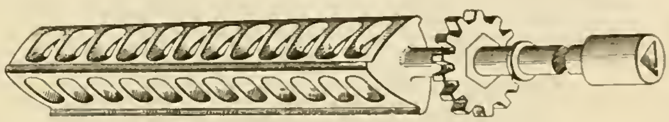
The New York Central Railroad Company has placed orders with several manufacturing companies for 25,000 cars costing about $1,000 each. This is the largest order ever placed by an American railroad. The equipment will be divided between the Central and the Lake Shore, and will be in service in 1906.

Incorrect Count.

Considerable merriment has been occasioned among railroad men in New York and vicinity by the exposure of a spurious "count," who said he was a Russian nobleman and that he had millions to spend on locomotives and railroad equipment. His contracts never went any further than a "square meal," for which he never condescended to pay. The police caught on to his game, but the magnates with whom he had the honor of dining refused to prosecute. The "count's" father is a humble attache of the Street Cleaning Department in Williamsburg, and the young man, who is a graduate of the high school there, was employed for some time as a Jefferson guard at the St. Louis Exhibition. It appears that he had met some real counts and began imitating them and blossomed into a "count" himself. He became the character admirably, and all he needed was to marry an American heiress.

Grate Bar.

An improved grate bar, suitable for use in a locomotive, as shown in the accompanying illustration has been invented and patented by Mr. Dwight S. Richardson, New York. Its chief features consist of solid transverse webs in a bar having three faces with three corners in cross section comprising a continuous longitudinal cutting edge at each corner, the three fuel bearing faces being convex in shape with webs equally spaced from one another forming air passages. Apparatus for turning the grates forms a substantial and readily cleared fire grate.



IMPROVED SHAKING GRATE.

Automatic Stoker.

Experiments have been going on for some time in the West Albany shops of the New York Central with an automatic stoker which, it is claimed, will introduce a method of saving 30 per cent. in coal consumption. The device is placed in front of the tender box, with which it connects by means of a long feed pipe leading to the furnace. A corkscrew arrangement carries the small coal and it is wafted into the fire by means of a fan. The machine takes up little space and is easily operated.

The Salt Lake Route has placed in operation their new equipment for their limited train which will make the run between Salt Lake and Los Angeles in twenty-four hours. This equipment is the most complete of anything now running west of Chicago. A special observation car is attached to each train, in which the passengers can see the marvelous scenic beauties through which the railway passes.

The saying, "Cast thy bread upon the waters and thou shalt find it after many days," has had a modern application. A Pittsburgh dispatch of recent date says: Fred Fleck, an old locomotive engineer of the Pennsylvania road, says he has received a letter from Andrew Carnegie, enclosing a check for $1,000 to pay for a luncheon which Mr. Carnegie ate in Fleck's engine cab years ago when he was riding with the engineer. Mr. Carnegie, it appears, was ravenously hungry, and gladly dined on the contents of Fleck's dinner paid. He has now paid for that meal.

The Ingersol-Rand Company have just issued a catalogue describing their stone channeling machines. The illustrations are in the highest style of the art, and with the letterpress give a comprehensive view of the operations of these rock cutting machines, some of which cut to a depth of 16 ft., the gauge or width of the cut depending on the final depth sought, averaging from one to four inches. Illustrations of their air compressors are also given.

The Electric Water Purifying Company have issued a pamphlet describing their water filtering apparatus with certificates of analysis by chemical experts showing the efficiency of the process in eliminating mineral and other substances from the water. As to the bacteriological results it is claimed that in a cubic centimeter of water containing 340,000 bacteria only 75 remained after being treated by the electric apparatus, and these were said to be innocuous.

The *Mechanical World* Pocket Diary and Year Book for 1906, published by Emmott & Co., Manchester, England, is an admirable compendium of useful engineering notes, rules, tables and data comprising nearly 400 pages of closely printed facts and figures of value to all interested in mechanical construction. The high standard of excellence of this annual is more than maintained, the extended new feature being a comprehensive but compact treatise on electric motors and appliances.

Heavy Plate Shear.

Our illustration shows a very substantially built Gate shearing machine which has been built by the Long & Allstatter Company, of Hamilton, Ohio, for a large manufacturing concern in St. Louis. The tool is capable of cutting a steel plate 50 ins. wide and 5/8 in. thick. It is single geared, and is quick acting, and is arranged for electric motor drive. The lower block is adjustable and the machine is provided with an automatic stop and an automatic holding down device. The builders have all through given special attention to the details of this powerful tool, the prominent idea which they kept before them was that of durability and efficiency, and all parts have been designed with that end in view. Those of our readers who are interested in obtaining further particulars of this Gate shear can do so by writing direct to the makers.

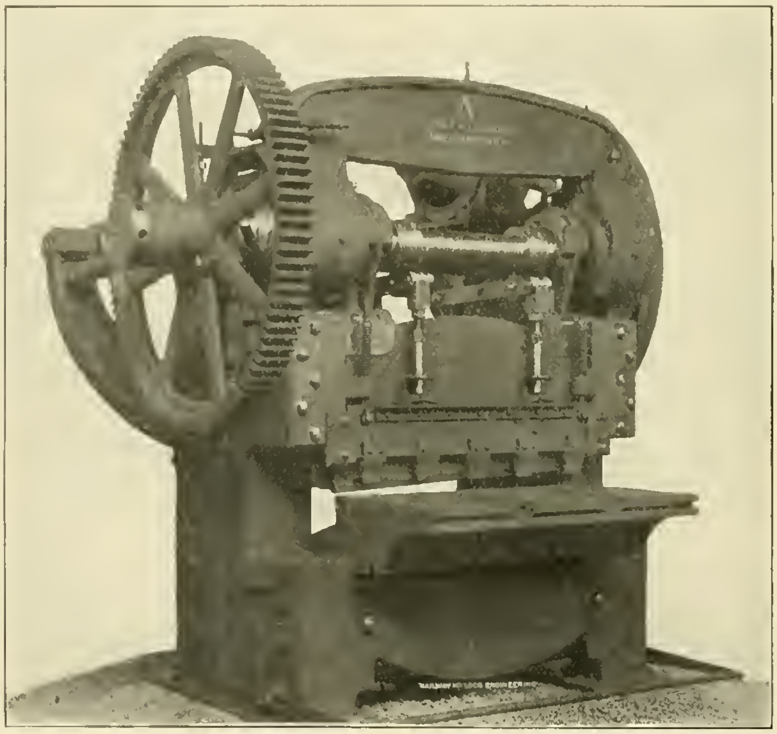


PLATE SHEARING MACHINE.

In connection with our much-discussed subject of railroad accidents, our railroad companies might profitably imitate a German practice. German locomotive engineers receive a gold medal and $500 for every ten years of road service without accident. If this was the way that our hero medal was given away, it would do some good.

"Luck," says Max O'Rell, "means rising at six o'clock in the morning, living on a dollar a day if you earn two, minding your own business and not meddling with other people's. Luck means appointments you have never failed to keep, the trains you have never failed to catch. Luck means trusting in God and your own resources."

The Watson-Stillman Company, New York, manufacturers of hydraulic machinery, have issued a profusely illustrated catalogue of 54 pages describing in detail some of their very large line of high pressure hydraulic tools, among which are a variety of types of accumulators. These machines bear the same relation to a hydraulic system that the balance wheel does to a steam engine, it receives the excess of pump delivery above the demand at the moment, and delivers it when the demand is above the normal. The machines are of all sizes, adapted to every need, and in the element of construction and in quality of material they could not be surpassed.

The first passenger railway was the Liverpool and Manchester Line, opened in 1829. When steam railways were first proposed the people considered them safe only for moving freight. The first declaration of consequence in favor of railways being made to carry passengers emanated from the father of Maria Edgeworth, the famous novelist.

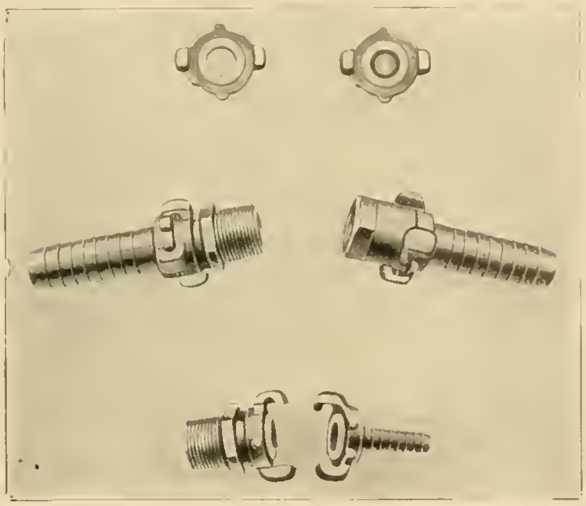
The New York, New Haven & Hartford Railroad have ordered 2,000 box cars from the Standard Steel Car Company, and 500 from the Keith Manufacturing Company.

Hose Coupler.

The hose coupler here illustrated was designed to meet the demand for a universal coupler, whereby a plant once standardized could economically thereafter be so maintained without the extra expense necessitated for special couplers made to suit the various sizes of hose used with pneumatic tools.

By reference to our illustration it will be observed that this coupler has no male or female part at coupling end proper, but instead each half has embodied therein both male and female features, thus providing that each half is exactly alike and will couple together regardless of the size and style of the shank. It will readily be seen that thus quarter inch hose can be made to couple with three-quarter inch hose, one-inch pipe, or anything having one of these couplers attached to it.

The shanks are made for pipe male thread, pipe female thread, and hose, in standard commercial sizes of from one-quarter inch up to one inch, which enables all couplings to be made without reducers or special shanks.



HOSE COUPLER FOR PNEUMATIC PIPE LINES.

These couplers are got out by the Chicago Pneumatic Tool Company, whose manufacturing facilities are equal to 500 sets per day. Special Circular No. 53 will be sent to those who apply to the company for a copy.

If you want to see a novel kind of folder which is really a folder, there is one issued in the Windy City which has this feature, that when it is opened a miniature semaphore signal made of cardboard goes to the "stop" position, and this, no doubt, indicates that the reader is expected to stop and think before going on. By reading, he naturally comes upon several "lines," not of rails, but of thought, and finds that hand and push cars, track drills, jacks, car replacers, switch stands, frogs, crossings and switches made by the Buda Foundry and Manufacturing Company, of Chicago, have occupied his attention. Having been held by a stop signal, he naturally thinks of "orders" before proceeding, and as he closes the folder the semaphore not inappropriately assumes the "all right" position, and everything is "clear" in his mind. If you would like to be thus "signaled," write to the company, in the Railway Exchange building, and ask for a folder.

A good, serviceable catalogue, well printed and well illustrated, has been got out by the Gold Car Heating and Lighting Company, of New York. It is the same size as RAILWAY AND LOCOMOTIVE ENGINEERING, and it contains 123 pages. The catalogue contains engravings and descriptions of all the company's devices for heating cars and for lighting them. The diagrams have all details numbered and named so as to be of use when ordering parts. The letterpress gives explanations of how any device works. The book is thus not only a catalogue in the ordinary sense of the word, but may be used as a reference work as well. It is up to date in every way, and, in fact, everything which is manufactured by the Gold Company is fully set forth in its pages. A number of facsimile letters from railway officials have been printed in the latter pages of the catalogue. Those entitled to receive a copy, and who have not already got one, should write direct to the Gold Company.

The Journal of the Worcester Polytechnic Institute for November contains an excellent illustrated article on "Shop Training for Mechanical Engineering." That there is much need for such training is evident to all who have come in contact with some of the graduates of some of these institutes. The shops in some of these technical colleges are wofully lacking in really effective instruction because of the lack of tools and machines. The Worcester Institute has established a complete system that apparently leaves nothing to be desired, and it would be well if all of our technical engineering colleges were modeled after this admirable institution.

In Norway the average duration of life is greater than in any other country in the world.

Crane Elephant.

When we speak of the Crane elephant, we do not refer to a sort of bird-like animal, we mean simply the neat little metal souvenir in the form of an elephant got out by the Crane Valve Company, of Chicago. On its back is cast the name of its maker and the figures representing the present year and the year in which the company was founded, viz., 1855. Therefore, the elephant carries its weight of years lightly. The end of its trunk is hooked up so that it will hold a pen off the desk without letting the ink get on to surrounding objects and in this the little pachyderm shows character, intelligence and strength, which are the virtues which the makers had in mind when they chose the emblem.

President Gompers, of the American Federation of Labor, says that the courts of New York State have been usurping the powers of the Legislature. The matter of course was that the upper courts have got into declaring laws unconstitutional because they favored the interests of labor, which justifies the labor people in concluding that the decisions are made with malice aforethought.

The Baltimore & Ohio Railroad Company is making good use of the excellent harbor at Fairport, Ohio, and as a result of the careful attention given dredging, a very satisfactory depth of water is maintained. The steamer "J. C. Wallace," with 10,310 gross tons of ore, recently came into the harbor, winded and went out without the use of a tug.

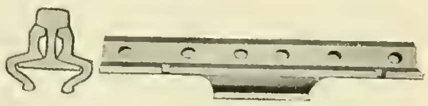
The increase of traffic on the Santa Fé system has necessitated the purchase of 45 new locomotives. Formerly it was the custom to place the new engines on the eastern divisions and push westward the older engines. This order has changed, and the bulk of the new engines will begin their industrial careers in California.

The Pullman Car Company have issued their annual report, showing that the net profits for the year are the largest in the history of the company. The company now pays 8 per cent. dividend on stock. Hon. Robert T. Lincoln, who was chosen to succeed the late Mr. George M. Pullman, as president of the company, has shown marked ability in management. The total receipts for the year approached $26,000,000.

The Scandinavian Belting Co., of Boston, have issued a circular which gives very high testimonials from firms using their "Scandinavia" belting, for both conveying and transmission. Among them are the Coplay Cement Co., Alpha Portland Cement Co., and the Lawrence Cement Co. The N. Y. Interurban Ry. is using one of their 30 in. conveying belts. The "Scandinavia" has a world-wide reputation for its strength and durability, being solid woven and not in plies. We are informed that over twenty million feet of this belting is running in different parts of the world. The inventor was the late William Fenton, of Stanley, Scotland, father of Mrs. A. Fenton Walker, with the Baker Car Heating Co., who is well known among railway men.

Duquesne Rail Joint.

A new form of rail splice or fishplate has lately been put on the market. It has been called by its manufacturers the "Duquesne" rail joint, no doubt after the famous fort of that name, formerly situated at Pittsburgh. The splicer has been designed for use with what is known as the suspension joint, or rail joint which does not rest upon a tie. The splice is bolted to the rail web in the usual way and supports the head or ball of the rail much the same as other



DUQUESNE RAIL JOINT.

splices do, but the space immediately below the joint and between the ties is occupied by an extension of the splice flange which is bent downward and inward below the rail as shown in our illustration. The lower edge of the splice flange is made with a small bulb, which increases it thickness and gives greater stiffness. The whole extension form a very rigid splice piece, as not only its form, but the thickness of metal used on the sides greatly increases its vertical strength above that of many existing forms.

The modern system of education is trying to make boys and girls study on the principle that they must know everything. These youths would be better prepared to enter the battle of life, if they did not know half so much but knew it well.

Not long ago the Erie Railroad officials unveiled a monument at Binghamton, N. Y., which was erected to commemorate the turning of the first sod in the construction of what is now the Erie system. This event took place at that point in 1835.

How Promotion Comes.

In "Locomotive Engine Running and Management," Mr. Angus Sinclair's earliest book, there is, among other incidents equally pointed and interesting, the story of a hot driving box and a midnight stoppage on a remote railroad, and there is just story enough given so that little imagination is required in conjuring up the musical accompaniment of the weird, wintry wind howling around the excited engineer, the desperate fireman, and the panic-stricken passengers, and the general gloom that gathers like a mantle of misery when the climatic conditions seem to conspire with the mechanical difficulties to magnify the miserable midnight muddle. There was a cellar under that box and how to take it out was beyond the knowledge of the bewildered engineer. The fireman knew less, if that were possible, and the numbed fingers of the desperate men clutched feebly at the frozen tools in an ineffectual attempt to slacken down and repack the burned box.

A sharp-eyed, clear-headed conductor came along to see what was the matter. He had been keeping abreast of the times by reading all there was to be read about railroading. He was neither a machinist nor an engineer, he was simply an observing, reading, thoughtful railroad conductor. He knew how the cellar was put in, and he knew how it should be taken out. It could not be driven down with a sledge. It drew out like a drawer in a bureau, and he quietly told them what to do and the thing was done, and in a few minutes the train was moving again, and peace settled down upon the weary wayfarers like a benediction.

Of course, the story was too good to be kept quiet. Somebody told the roundhouse foreman, and it soon reached the office, and it became magnified, and the engineer was reprimanded, and the fireman was frightened, and everybody took a hint and became more studious, and the conductor was promoted, and he kept on climbing the ladder of success that led him in a few years to a high position.

This is an example of the way to success which is open to everybody. It shows that to be successful in railroad work, literature is indispensable. It shows that RAILROAD AND LOCOMOTIVE ENGINEERING should not only be in the hands of every man engaged in the mechanical departments of railroad work, but every man on railways should con its pages. The price, $2.00 a year, places it within the reach of every railroad employee.

"Twentieth Century Locomotives," Angus Sinclair Co., deals comprehensively with the design, construction, repairing and operating of locomotives and railway machinery. First principles are explained. Steam and motive power is dealt with; workshop operations described, valve motion, care and management of locomotive boilers, operating locomotives, road repairs to engines, blows, pounds in simple and compound engines; how to calculate power, train resistance, resistances on grades, etc. Shop tools explained. Shop receipts, definitions of technical terms, tables, etc. Descriptions and dimensions of the various types of standard locomotives. The book is well and clearly illustrated and is thoroughly up to date in all particulars, fully indexed. Price, $3.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." Price, $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. We sell it for 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. It sells for 75 cents.

The 1904 Air Brake Catechism. Conger. Convenient size, 202 pages, well illustrated. Up-to-date information concerning the whole air brake problem, in question and answer form. Instructs on the operation of the Westinghouse and the New York Air Brakes, and has a list of examination questions for enginemen and trainmen. Bound only in cloth. Price, $1.00.

"Compound Locomotives." Colvin. This books instructs a man so that he will understand the construction and operation of a compound locomtive as well as he now understands a simple engine. Tells all about running, breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size, 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion, it is easily understood by every intelligent fireman. The price is 50 cents.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable, and, best of all, they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Standard Train Rules." This is the code of train rules prepared by the American Railway Association for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotive, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

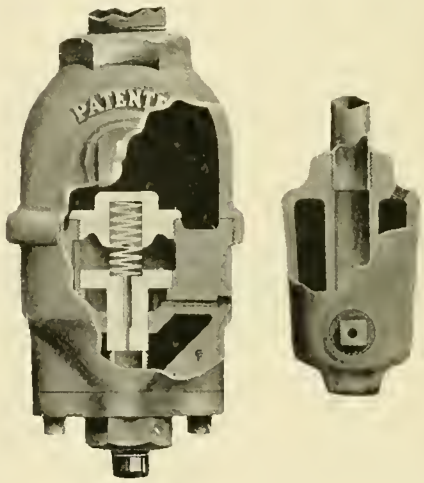
"Simple Lessons in Drawing for the Shop." By O. H. Reynolds. This book was prepared for people trying to acquire the art of mechanical drawing without a teacher. The book takes the place of a teacher, and has helped many young men to move from the shop to the drawing office. 50 cents.

"Locomotive Running Repairs." By L. C. Hitchcock. This book contains directions given to machinists by the foreman of a railroad repair shop. It tells how to set valves, set up shoes and wedges, fit guides, care for piston packing, and in fact perform all kinds of work that need a thoughtful head and skilful hands. 50 cents.

Railway and Locomotive Engineering. Bound volumes. $3.00.

Baker Sander and Heater.

Geo. A. Baker, of Norwich, N. Y., has placed on the market an automatic, adjustable, self-cleaning sander which has many good points. It combines the qualities of a force as well as a suction sander, the air pressure being admitted above as well as below the opening valve. There is also a heater attached to the sand pipe near the rail for the purpose of keeping the pipe hot, and insuring an open pipe for sand all the time. The device is automatic in its action and self-cleaning and seems well adapted for all the requirements of a reliable sander.



BAKER SANDER AND HEATER.

"He is not wise, if wisdom is to say a thing a hundred times when once will do. There is no regret so keen, in man or country, as that which follows an opportunity unembraced. Hs is not conservative, if conservatism means waiting until it is too late."

We have a copy of that famous engineering book, "Clark's Railway Machinery," for sale. It ought to be in every first class library. The price is $30.

Quartz is the most widely distributed of all minerals. Pure quartz is an oxide of silicon.

Mr. William Dean.

Mr. William Dean, for many years locomotive superintendent of the Great Western Railway of England, died recently at Folkstone, Kent. He was forty-seven years in the employ of the company, and introduced many marked improvements in the English system. He was universally respected and esteemed as an engineer

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Front Enders.

A story comes from Chicago through the medium of the daily press of a little girl who had an unexpected ride on the front of a locomotive, not long ago. The story goes that this little nine-year-old maiden was returning home accompanied by a small collie dog with the commanding name of Governor. She had crossed the tracks of one of our western roads, but the governor remained behind to investigate. An engine pulling a freight train came along, but the animal failed to vacate the right of way and turned a deaf ear to the warning voice of the little miss. Seeing that dog and engine were about to try conclusions, the child rushed in front of the engine and seized the collar of her pet. Before she had time to get clear the engine was upon her and she caught hold of and somehow clambered up on the pilot. She and Governor were carried three miles up the track before anyone found out what had happened. The occurrence took place on the left side and the engineer did not see how the pair of front-end passengers got aboard. Everything turned out all right, according to the press dispatch, but nothing is said about a crossing watchman.

The Chicago & Northwestern has just placed in service 20 new sleeping cars, said to be the finest that the Pullman Company has ever turned out. The new features are two staterooms in addition to the usual drawing-room, dressing tables, beveled mirrors, electric lights and electric curling irons. The upper berths are raised or lowered on noiseless pulleys. The finishings are in oak.

Fire Chief Kerrigan, of Cheyenne, Wyo., has ordered the Union Pacific, Colorado & Southern Railway Company to equip their switch engines with spark arresters. It is said that eight fires occurred in one day from sparks from switch engines. The company have issued orders that the Rock Springs coal be used instead of the Hanna coal, the sparking properties of the latter being in a great degree responsible for the fires.

At the annual meeting of the Canadian Pacific Railway Company, held at Montreal last month, the stockholders authorized the directors to issue $7,500,000 of capital stock for the purchase of additional equipment The result of the large expenditures will be to place the road on an equality with any trans continental lines in condition and capacity for handling traffic.

The Hendrick Manufacturing Company, of Carbondale, makers of Perforated Metals and General Sheet Iron Work, have recently placed Mr. Byram C. Guerin in charge of their New York office, at 149 Broadway. Mr. Guerin has for the past two years been connected with a Baltimore firm of importers and dealers in metals. The Hendrick Company are at present increasing their facilities for handling their business.

The Harriman lines in Oregon are being reconstructed with a view to accommodate the heaviest locomotives. The equipment includes sixteen new steel bridges. Work on the massive concrete foundations is already begun. A block-signal system is also being installed.

The employees in the shops of the Santa Fe Railroad, at Topeka, Kan., are continuing the building of locomotives of an exceptionally high order of merit. Their types of freight engine are said to be the best in the service of the company. They are designed by Santa Fe men.

The Atchison, Topeka & Santa Fe Railroad has entirely abolished the hand car, and in its stead are neat cars propelled by gasoline motors. The car will carry seven or eight men and baggage and provisions at a speed of thirty miles an hour.

An editor in Illinois who started about twenty years ago with 15 cents, is now worth $100,000. His accumulation of wealth is owing to his frugality, strict attention to business and the fact that an uncle died and left him $99.998.

It is said that in Germany locomotive engineers receive a gold medal and an amount equivalent to $500 for every ten years of service which they have rendered and which have been free from accident.

The Pennsylvania Railroad Company has ordered about 25,000 tons of steel—structural and rails—for immediate delivery. Twelve thousand cars have been ordered this year, and all are to be equipped with air-brakes.

Lake Ladoga, with an area of 7,000 square miles, situated near St. Petersburg, is the largest lake in Europe.

A neat little booklet has just come to hand. It is Bulletin No. 75, entitled "Mechanical Draft: What It Is, What It Does," and has been issued by the B. F. Sturtevant Co., of Boston, Mass. This booklet not only briefly presents the salient features of this system of draft production, but illustrates a variety of plants which clearly show "what it is." The query "what it does" is thus answered: It does what an ordinary chimney does not do; it permits the burning of finely divided or low-grade fuel; it makes possible the utilization of the heat of the flue gases which a chimney uses in producing draft; it is independent of the weather; is automatically regulated to maintain constant steam pressure, decreases smoke, increases the capacity of an existing plant, and may serve as an auxiliary to an overburdened chimney; it saves space, and is portable.

The Lake Shore Railway repair shops, at Buffalo, have reopened with a force of 600 men, and the works will soon be in full operation. When the buildings were opened over forty years ago they were looked upon as the perfection of railway shop building at that time. The machinery is entirely new.

It is reported that the new law requiring the inspection of locomotive boilers in the State of New York has resulted in the inspection of 5,000 boilers in the last three months. No State inspector has yet been appointed.

The Erie Railroad is furnished with a new pit at East Buffalo, where three of the largest locomotives can be supplied with coal, water and sand at once. Ashes are dumped and fire cleaned at the same time.

The New York Central has placed orders for steel rails to cost $14,000,000. Of this the Illinois Steel Company will furnish 60,000 tons. The Pullman Company will build at least 10,000 freight cars. The order for steel rails will aggregate 145,000 tons.

The Missouri Pacific Railroad people, who have always been embarrassed for want of proper rolling stock repair shops, have recently completed fine works at Sedalia, Mo., where the greater part of the locomotive repairs will be concentrated.

It has been announced that the Union Pacific purpose erecting extensive locomotive works in Omaha, and that the company will build its own locomotives. The estimated cost of the works will exceed $350,000, and the work will be proceeded with as rapidly as possible.

The "Bedbug" Special.

Probably the only train in the world of its kind and name is now going over the main line and branches of the Union Pacific. It is equipped with all modern appliances for exterminating bugs and insects of all kinds, and will fumigate all the section houses on the system. Steam from the engine is carried to the car where it is mixed with poisons or disinfectants according to requirements, and the building sprayed inside and out by means of hose and suitable nozzles.

One Cause of Success.

The rise in the world of many a good man has been solely due to the fact that he has strictly attended to the business entrusted to him and let the business of other people severely alone.

New Railroad.

The contract has been let for building the first 20 miles of the Cumberland River & Nashville. This road is to run from Corbin, Ky., to Nashville, 200 miles. It will penetrate some very fine coal and timber lands, and will pass through the Wayne county oil fields.

A Duke at the Throttle.

The Duke of Sutherland is perhaps the best locomotive engineer in the British peerage, and could earn a living at the work di l he so desire. A private railway 30 miles long connects his Dunrobin castle with the main line, and the Duke often handles the throttle over this stretch of track.

Suicide of 326.

At irregular intervals the imaginative writers who work up copy about railroad doings produce some ghost story about balky locomotives that display mule-like perversity when handled by men they do not like. The latest outbreak of this mild form of idiocy appeared lately in the New York *Sun* in the form of a story called the "Suicide of 326." This was a good, respectable engine, as the story goes, that had no bad habits and was a pet of Jim Cregans. In the course of nature Jim was called elsewhere, and then his old favorite sulked and displayed bullheaded resentment that its old engineer no longer pulled the throttle. Bad humor was displayed in a variety of ways and no engine crew could do anything useful with the old mill. One day the road foreman of engines talked of scrapping the misbehaving engine and it forthwith took the bit in its mouth, so to speak, or, rather, opened the throttle and ran recklessly into a swamp, as certain relatives had acted years before by running down a steep place into the sea.

Great is the imagination. We suggest

that the next time the locomotive ghost story teller wants something outlandish to dish up for railroad men that he tell about the engine house that got tired of staying at home and ran away with twenty-one engines in tow. That would make something like a yarn.

Some Observations on Acetylene.

Acetylene gas is generated by the chemical decomposition of water and calcium carbide. It is a permanent gas and of greater density than the ordinary coal gas, though less in volume per unit of weight. It will pass through a smaller aperture than ordinary coal gas. Notwithstanding the fact that this is a high power illuminant, no case of asphyxiation from it has so far been reported.

The composition of calcium carbide, which forms the principal ingredient of this gas, is formed from a mixture of about 60 per cent. of lime and 40 per cent. of powdered coke. This mixture is subjected to intense heat, by which the carbon of the coke is enabled to chemically unite with the lime. When the mass cools it is crushed to commercial sizes, and is carried in iron drums that are air and water tight. The calcium carbide has an intense affinity for water and must be kept from contact with even the moisture of ordinary air. The chemical transformation which takes place when water is added to the carbide may be represented as follows: $Ca\,C_2 + H_2O = C_2\,H_2 + Ca\,O$, when expressed in words the formula reads, Calcium carbide plus water gives Acetylene gas and slaked lime. Any excess of water simply makes a solution of lime, which may be used for the making of mortar or the lime-washing of walls and buildings.

The problem of storage of this gas has been very successfully met by the Commercial Acetylene Company, of New York, in what they call their dissolved system. A storage cylinder made of the highest quality of sheet steel is used, which is guaranteed to stand a pressure of 1,200 lbs. per sq. in. This cylinder is fully filled with perfectly fitting disks of asbestos, which have a porosity of about 80 per cent. By means of suitable apparatus this cylinder is filled with acetone, equal to 43 per cent. of the volume of the storage tank.

Acetone is a liquid produced by the destructive distillation of woody fiber, and is similar to wood alcohol. When in the storage cylinder it completely saturates the asbestos. One of the properties of this liquid is its ability to dissolve acetylene at ordinary temperatures. Acetone dissolves 23 volumes of acetylene at 62° F. The storage cylinder is charged with acetylene up to 150 lbs. pressure. Acetylene stored in a porous substance like asbestos and held in solution by acetone, cannot explode while in the cylinder. Tests made with a cylinder so charged showed that when heated to a dull red, the contents carbonized, but no explosion took place.

A railroad car equipped with this form of light and used in suburban service will last about three months without recharging. Gas from the tank can be drawn off as required, the amount varying slightly with the temperature of the surrounding atmosphere. A regulating valve interposed between the storage tank and the car lamps feeds the illuminant constantly at low pressure to the burners. There is a safety relief device also provided so that if by any remote chance the pressure in the low pressure piping should rise as high as 5 lbs. per sq. in., the relief apparatus would operate and vent the gas outside the car.

A miniature electric central station on wheels has been patented by Mr. Hugh Reid, of the North British Locomotive Company, Glasgow. It is something like the Herbmann electric locomotive that was tried in France several years ago, and proved a failure. The leading difficulty with inventions designed to generate power on a movable vehicle is that the weight to be carried is too great for economical development of tractive power. The trolley arrangement vanquishes such appliances when the question of economy arises.

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